

PROCEEDINGS  
OF  
The Academy of Natural Sciences  
OF  
PHILADELPHIA  
(Founded 1812)

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VOLUME LXXXVII  
1935

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THE ACADEMY OF NATURAL SCIENCES  
OF  
PHILADELPHIA  
1936

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DESCRIPTIONS OF MIDDLE AMERICAN LAND AND FRESHWATER  
MOLLUSCA

BY HENRY A. PILSBRY.

Various snails, mainly from Mexico and Central America, which have accumulated in the museum of this Academy are here described and figured. Most of them were received from Professor Carlos de la Torre, Mr. James Zetek, and Mr. James Bond; a few others have been in the collection for many years.

**Humboldtiana torrei**, new species. Plate 1, fig. 10.

San Antonio y Santa Rosalia, near and south of Chihuahua, State of Chihuahua, Mexico. Type and paratype 162325 A.N.S.P., collected by Professor Carlos de la Torre about 1899. Also in coll. Torre.

The shell is obliquely perforate, depressed, the height about three-fourths of the diam. White with diffuse pale flesh tinted stains and with three narrow, uneven, wood-brown bands. The four whorls increase rapidly, the last very rapidly. Embryonic shell of  $1\frac{1}{2}$  smooth whorls; subsequent whorls with sculpture of irregular growth wrinkles, without spiral lines or granulation. The last whorl is rounded peripherally and descends deeply to the aperture. The aperture is strongly oblique, truncate-oval, banded within. The outer and basal margins of peristome are expanded, fleshy brownish; columellar margin is whitish, broadly reflected, nearly covering the umbilicus. The short parietal callus is white.

Height 28 mm., diam 39.2 mm. Type.

Height 28.5 mm., diam. 40.3 mm. Paratype.

This very distinct species differs from all of those known by the total absence of granulation. The large size, thicker lip, wide and very oblique aperture, and the color, distinguish it from *H. chisosensis*, which is the only equally depressed species, and which differs also by the possession of weak granulation.

**Humboldtiana högeana** (von Martens). Plate 1, fig. 9.

A topotype labelled Chihuahua city (Torre) is figured. In this species the embryonic shell has close, fine costulation partly broken into granules. The first neanic whorl has a weak granulation. The last whorl is sculptured with coarse growth wrinkles, part of them whitish. The later whorls have no granulation. Height 31 mm., diam. 33.5 mm.; 4 whorls.

**Humboldtiana ferrissiana** Pils. Plate 1, figs. 5, 6.

*Nautilus*, vol. 41, p. 82, Jan. 1928. Miter Peak, Davis Mountains, Texas.

This species has not been figured hitherto. It resembles *H. högeana* in sculpture, but is decidedly more depressed, with the third band situated higher. The granulation is limited as in *högeana*. In *H. palmeri* Clench and Rehder, illustrated in Plate 1, fig. 11, the granulation extends to the end of the last whorl. The embryonic whorls are much alike in these three species.

**Bulimulus (Leptobysus) sanmarcosensis** Pils. and Lowe. Plate 1, fig. 8.

*Bulimulus sanmarcosensis* Pilsbry and Lowe. *Nautilus*, vol. 46, p. 49, 1932.

San Marcos Island, Gulf of California. The type is figured.

**Bulimulus (Leptobysus) carmen** Pils. and Lowe. Plate 1, fig. 7.

*Bulimulus carmen* Pilsbry and Lowe. *Nautilus*, vol. 46, p. 50, 1932.

Carmen Island, Gulf of California. The type is figured.

**Holospira torrei**, new species. Plate 1, fig. 4.

Mexico. Type 162324 A.N.S.P., collected by Sr. Botteri, received from Dr. Carlos de la Torre.

The shell is rather shortly rimate, cylindric but with slightly convex outlines, passing gradually into the conic summit; glossy; pinkish white with some flesh-colored stains. The first two whorls are smooth and glossy, forming a nipple-like apex; the following three or four whorls are marked with very fine retractively slanting striae; whorls of the cylindric portion are nearly smooth; in the middle of the antepenult whorl fine riblets begin, gradually becoming stronger, the last two whorls having rather coarse, strong, regular riblets. There is a spiral impressed zone around the base of the last whorl. The aperture is shortly ovate; peristome reflected, the parietal margin built forward shortly. Internal axis with a strong, horizontal columellar lamella in the penult whorl, continuing weakly in the last; basal and parietal lamella strong, occupying the first two-thirds of penult whorl; palatal lamella occupying the first half of the penult whorl and not continuing so far forward as the other lamellae; it is long and strong, and situated at about the anterior third of the height of the whorl. Length 22.5 mm., diam. at the 11th whorl 6.3 mm.; 15½ whorls.

This is one of the largest species of the typical section of *Holospira*. Señor Botteri collected mainly in the State of Vera Cruz, but the locality of this form was not recorded.

**Aperostoma (Amphicyclotus) princeps**, new species. Plate 1, figs. 1, 1a, 1b.

*Cyclotus boucardi* Angas. Proc. Zool. Soc. London, p. 483, 1879.

Mouth of Banana River, five miles from Limon, Costa Rica. Type 12930 A.N.S.P., collected by Wm. M. Gabb.

The shell is openly umbilicate, the umbilicus very regularly diminishing and showing all the whorls to the apex, occupying about one-fifth of the diameter. Spire rather low, conic, the first four whorls dull pink, the rest cartridge buff with a white zone at and above the periphery, and two brownish-ochraceous bands, the wider one fading at its edges, occupying the middle of the upper surface, the narrower band a little darker and more sharply defined, immediately below the periphery. Sculpture: after the first  $2\frac{1}{2}$  smooth whorls there is a close, even corrugation, the rugae running spirally and slowly ascending forward; this corrugation covers all the surface except the interior of the umbilicus and a narrow subsutural band. There are barely 6 strongly convex whorls, the last flattened or slightly concave below the suture. The suture is impressed, becoming narrowly incised near the aperture. The aperture is strongly oblique. Peristome not expanded, the outer margin arching forward, retracted to the upper angle, somewhat thickened a short distance within the thin edge. Columellar margin blunt, retracted, continuous with the parietal callus, which has a rounded sinus close to the posterior angle. Height 33 mm., diam. 49 mm., width of umbilicus 10 mm.

This species differs from *A. boucardi* (Pfr.) by the continuous, regular rugae of the surface, by the form of the peristome and the color pattern. Only one specimen was collected.

**Aperostoma princeps angasianum**, new name.

*Cyclotus boucardi* Angas. Proc. Zool. Soc. Lond., p. 73, pl. 5, fig. 3, 4, 1878 (San Carlos, Costa Rica). Not *Cyclostoma* (*Cyclophorus*) *boucardi* Pfr., 1856.

As *Cyclostoma boucardi* Pfeiffer is an *Aperostoma*, the name of Angas's form must be changed. The two are perfectly distinct though allied species, belonging to the same section (*Amphicyclotus*) of the genus.

*A. p. angasianum* is known to me only by Angas's description and figure. It measures, height 26 mm., diam. 33 mm., being much smaller and relatively higher than *A. princeps*. However, it is to be noted that the large aperostomas are rather variable in size in different places; thus, *A. underwoodi* (DaCosta) varies from the large typical form, 45 to over 46 mm. diameter, to only 39 mm. (at La Emilia, near Guapiles, Costa Rica, J. A. G. Rehn, 1923); the smaller shells being also relatively higher.

**Aperostoma (Amphicyclotus) palenquense**, new species. Plate 1, figs. 3, 3a, 3b.

District of Palenque, State of Chiapas, Mexico. Type and paratype 106344 A.N.S.P., collected by Dr. C. S. Dolley.

The shell is depressed, solid, openly umbilicate, showing all the whorls, the width of umbilicus contained slightly over four times in the diameter of the shell; sepia colored, becoming dull purplish on the denuded spire and somewhat tawny near the apex. Sculpture of low, irregular, interrupted



rugae spirally ascending forward. Whorls  $4\frac{1}{2}$  (plus an apical whorl lost by erosion), convex, the last flattened below suture. The aperture is very oblique, angular and slightly channelled above. Peristome noticeably dilated, thick, the parietal callus straight, very oblique, columellar margin receding. Height 21 mm., diam. 34 mm., width of umbilicus 8 mm.

Compared with *A. boucardi* (Pfr.) from Cordova in the State of Vera Cruz, the whorls of *A. palenquense* do not increase in caliber so rapidly, the last whorl and the aperture being smaller; the aperture is more oblique, the lip decidedly thicker and the umbilicus larger. It is also less elevated than *A. boucardi*, and differs in details of sculpture and color.

The genus *Aperostoma* is divisible into several subgenera or sections based mainly upon the system of sculpture, as follows:

1. Sculpture of fine axial striae or costulae only; peristome varying from reflected to simple. Subgenus *Aperostoma* Troschel, type *A. mexicanum* (*Cyclostoma mexicanum* Menke).

2. Sculpture of fine costulae and stronger spiral threads and cords; peristome reflected. Subgenus *Aperostomops* (new); type *A. purum* (*Cyclostoma purum* Forbes).

3. Sculpture of close spiral cords only; peristome simple. Subgenus *Calaperostoma* (new); type *A. cumingi* (*Cyclostoma cumingii* Sowb.).

4. Sculpture of continuous or interrupted obliquely spiral corrugation; peristome not reflected, often sinuated above. Mainly large, dark colored or variegated species. Subgenus *Amphicyclotus* Crosse & Fischer, type *A. boucardi* (*Cyclostoma boucardi* "Sallé" Pfr.).

***Poteria vincentina***, new species. Plate 1, figs. 2, 2a.

St. Vincent, B. W. I. Type and paratypes 12953 A.N.S.P., collected by Robert Swift about 1870. Also taken by Mr. James Bond, 1929.

The shell has about the shape of *P. straminea*. It is solid, tawny, fading to yellow at the suture and on the base, streaked with chestnut or burnt sienna, and with a few black lines marking former peristomes. The surface is glossy; the first  $2\frac{1}{2}$  whorls smooth, the rest closely granose-corrugated. The whorls are convex, suture well impressed. The aperture is subcircular, angular posteriorly. Peristome outwardly somewhat thickened within, the basal and columellar margins rather thick. Height 16.5 mm., diam. 24 mm.; umbilicus about 4.5 mm. wide;  $4\frac{1}{2}$  whorls.

The operculum is flat, showing about 8 whorls, which are slightly prominent along the suture.

*Poteria straminea* (Rve.) has much more regular corrugation and a smaller aperture. *P. rugata* (Guppy) and *P. grenadensis* (Shuttl.) are decidedly smaller but closely allied species.

The type lot of this species bears a label in Swift's hand stating that Thomas Bland proposed describing the species; but I have not found that any description was published, and as the name he had chosen is not characteristic and seems not to be in print, I have substituted that of the island.

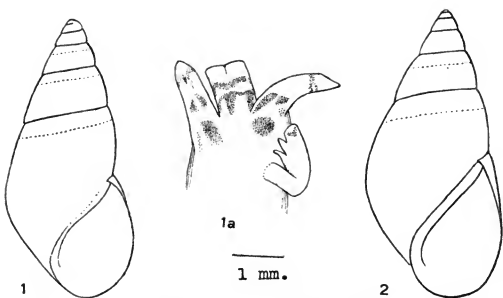
**Littoridina frenata**, new species. Text-figs. 1, 1a.

Rio Juan Díaz, Panamá. Type 161776, paratypes 161777 A.N.S.P.; collected by James Zetek, Feb., 1932.

The shell is imperforate, narrowly oblong-conic, quite solid and strong though not thick; olivaceous-yellowish, with a rather wide ill-defined darker border below the suture. Surface glossy, very lightly striate, and with weakly developed microscopic spiral striation discernible in some places. Spire straightly conic, of perceptibly convex though nearly flat whorls, the last flattened above the broadly rounded periphery. The aperture is ovate, occupying about 43 per cent of the length. Peristome smoothly finished, blackish. Columella and parietal callus very slightly thickened. Length 5.6 mm., diam. 2.5 mm., aperture  $2.3 \times 1.5$  mm. 6 whorls.

The animal (in alcohol) is pale gray with black markings. The tentacles are very broad, somewhat flattened, with bluntly conic tips; near the end of each there is a black band, and towards the base several dark gray spots as shown in the figure. Some distance from the end of the rostrum there is a black band, and at its base three triangular black spots, more or less connected. The verge has a blunt end with a black band near it; on the left or forward side there are two short branches (fig. 1a).

This species differs from *Littoridina melanioides* and *L. tenuis* v. Mart. (described as *Amnicola*) by the shape of the last whorl and the wider aperture. It does not have the calloused columella of the former.



FIGS. 1, 1a, *Littoridina frenata*.

FIG. 2. *Littoridina martensi*.

**Littoridina martensi**, new species. Text-fig. 2.

Rio Fula, Nicaragua. Type 27227, paratypes 27231 A.N.S.P., collected by J. A. McNiel.

The shell is imperforate, ovate-conic, rather solid and strong though not thick; olivaceous yellowish with a wide subsutural margin rather weakly marked by difference in color. Smooth. Spire straightly conic, the apex acute. Whorls with only slight convexity. The aperture is angularly ovate,

nearly half as long as the shell; peristome black. Columella and parietal margin are rather heavily calloused. Length 5.75 mm., diam. 2.7 mm., aperture 2.8 x 1.75 mm. 6 whorls.

This species agrees with the Costa Rican *L. melanioides* (V. Mart.) in having a decidedly calloused columella, but it is a much more obese shell with wider aperture, according to Von Martens's figure. *L. tenuis* (V. Mart.), which I believe is specifically distinct from *L. melanioides*, also differs in outline and aperture.

#### EXPLANATION OF PLATE 1

- Figs. 1, 1a, 1b.—*Aperostoma princeps*, n. sp. Type. 12930.  
Figs. 2, 2a.—*Poteria vincentina*, n. sp. Type. 12953.  
Figs. 3, 3a, 3b.—*Aperostoma palenquense*, n. sp. Type. 106344.  
Fig. 4.—*Holospira torrei*, n. sp. Type. 162324.  
Fig. 5.—*Humboldtiana ferrissiana* Pils. Type. 144338.  
Fig. 6.—*Humboldtiana ferrissiana* Pils. Paratype. 144339.  
Fig. 7.—*Bulimulus (Leptobyrsus) carmen* Pils. & Lowe. Type. 158995.  
Fig. 8.—*Bulimulus (Leptobyrsus) sanmarcosensis* Pils. & Lowe. Type. 158976.  
Fig. 9.—*Humboldtiana högeana* (Martens). Topotype. 162326.  
Fig. 10.—*Humboldtiana torrei*, n. sp. Type. 162325.  
Fig. 11.—*Humboldtiana palmeri* Clench & Rehder. Head of Madera canyon, Mt. Livermore, Davis Mts., Texas. 151227.

## TERTIARY FRESH-WATER MOLLUSKS OF THE MAGDALENA EMBAYMENT, COLOMBIA

BY HENRY A. PILSBRY AND AXEL A. OLSSON.

WITH TERTIARY STRATIGRAPHY OF THE MIDDLE MAGDALENA VALLEY, BY O. C. WHEELER.

- I. Introduction
- II. Descriptions of species
- III. Tertiary Stratigraphy of the Middle Magdalena Valley, by O. C. Wheeler

### I. INTRODUCTION

The fossil faunas described in this paper, occur in relatively narrow zones in a Tertiary section about 4300 feet thick and separated from each other by relatively barren beds. Of the three faunal zones which characterize the Los Corros, the Mugrosa and the La Cira formations, it is important to note, that the various species are all strictly limited to one zone or formation although they may occur in great numbers in the horizon to which they belong. From this fact alone, it is quite evident, that these formations must differ widely in age. Although final and lasting age assignments of the fresh-water Tertiary formations of the Magdalena valley cannot be made at this time, it is believed that the Los Corros fauna belongs to the late Upper Eocene, and is about equivalent to the Saman formation of northern Peru, the late Jacksonian of the southern United States, and the Ludian of Europe. This correlation is based partly on stratigraphy and partly on faunal evidence. As now understood, the Los Corros fauna is radically different from the succeeding Mugrosa in containing at least two (and possibly other) generic types peculiar to this formation. The interesting clam, *Sogamosa cyrenoides*, is generally very abundant and is apparently restricted to this formation. *Diplocyma* of which there are two species in the Los Corros, occurs also in the Saman of Peru where it is represented by "*Tympanotonus*" *lagunitensis* Woods, which is very closely related to the species described in this paper as *D. sucionis*. *Potamides mcgilli*, when more fully known, may perhaps also belong to a hitherto unrecognized genus. These faunal features give to the Los Corros assemblage an Eocene rather than an Oligocene aspect.

Marine Upper Eocene rocks are very widespread in the coastal region of northern Colombia, as well as in northern South America in general, and were deposited during one of the most extensive marine transgressions of Tertiary times. It seems reasonable to believe that the non-marine equivalent of these rocks should occur in the Tertiary embayments, so well exemplified by the deposits of the Magdalena valley.

In the Mugrosa formation, we note a greater development of the river snails of the genus *Hemisinus*. Some of these species as *H. mugrosana*, are closely related to the group of species of this genus described by Brown and Pilsbry and by Cooke from the Antiguan and Cuban Oligocene. It is believed that the Mugrosa formation should be correlated with the Antiguan formation and is therefore about Middle Oligocene in age. The presence of abundant glauconite in the Mugrosa formation is evidence that these beds may be unconformable on the Los Corros. Undoubtedly additional collecting will add many more species to the Mugrosa fauna as many collections from this horizon examined contain very poorly preserved fossils which cannot be identified.

The La Cira fauna is the richest in the number of recognizable species and, in addition to those described in this paper, many others are indicated by material too poorly preserved for description. The genus *Hemisinus* is well represented, and in addition to the group with cancellated shells, *Longiverena*, already known from the Mugrosa formation, we may note the introduction of members of the subgenus *Verena*, a group still living in the rivers of South America, and now first recognized as fossil. Among the small snails of the family Amnicolidae, there is a species of *Potamopyrgus*.

Among the naiades there are four species belonging to as many genera, all of which are represented in the recent fauna of South America. Probably the most interesting of these is *Triplodon latouri*, fairly closely related "*Hyria*" *wheatleyi* Marshall, a recent species of the Rio Negro. Both of these species should possibly be referred to the subgenus *Ecuadorea* Marshall, based on *Ecuadorea bibiana* Marshall, a fossil species from the late Tertiaries, probably Pliocene, of Ecuador.

In the La Cira we find also a brackish-water element in the presence of two species of *Corbula* and one species of *Mytilopsis*. The Corbulae usually occur in great numbers in an oolitic iron-stone which originally may have been more or less glauconitic. With them are species of *Hemisinus* and *Potamopyrgus* both of which are fresh-water mollusks. *Mytilopsis* occurs with *Verena* and the naiades. It is rather a curious mixture, and we are somewhat at loss to understand the ecological conditions under which these species lived. It seems most probable that the waters were fresh but close enough to the sea to be within tidal influence.

On the basis of stratigraphy, the La Cira formation cannot be older than the Upper Oligocene if the Mugrosa be correctly referred to the Middle Oligocene. The diversified La Cira fauna has a rather modern aspect in that all the genera belong to recent groups. It is our belief that the La Cira belongs either to the Upper Oligocene or more likely Lower Miocene.

The following species belong to the Los Corros fauna:

<i>Hemisinus (Basistoma) corrosensis</i>	<i>Diplocyma suciones</i>
<i>Potamides mcgilli</i>	<i>Sogamosa cyrenoides</i>
<i>Diplocyma wheeleri</i>	

The following species belong to the Mugrosa formation

<i>Hemisinus (Hemisinus) sigmachilus</i>	<i>Hemisinus (Longiverena) eucosmius</i>
<i>Hemisinus (Longiverena) hopkinsi</i>	<i>Hemisinus (Longiverena) lapazana</i>
<i>Hemisinus (Longiverena) mugrosana</i>	

The following species belong to the La Cira formation:

<i>Hemisinus (Longiverena) waringi</i>	<i>Diplodon (Rhipidodonta) oponcitonis</i>
<i>Hemisinus (Longiverena) lacirana</i>	<i>Monocondylaea (?) marshalliana</i>
<i>Hemisinus (Verena) avus</i>	<i>Anodontites laciranus</i>
<i>Hemisinus (Verena) laeovicarina</i>	<i>Mytilopsis cira</i>
<i>Hemisinus (?) gracillimus</i>	<i>Corbula (Corbula) abundans</i>
<i>Potamopyrgus lacirana</i>	<i>Corbula (Erodona) magdalensis</i>
<i>Triplodon latouri</i>	<i>Ostomya colombiana</i>

## II. DESCRIPTIONS OF SPECIES

### AMNICOLIDAE

#### POTAMOPYRGUS Stimpson

**Potamopyrgus laciranus**, new species. Plate 5, fig. 6.

La Cira formation: near Zopffs, La Cira district. Type 13074 A.N.S.P., collected by W. W. Waring. Also at many other localities near La Cira.

Shell very small, whitish, elongate-conic, the spire generally 3 to 4 times the length of the aperture. Whorls about 6, moderately convex between deep sutures. Nuclear whorls small, not well showing on any of our specimens. Surface smooth, porcellaneous, generally with 3 to 5 fine, raised spiral threads, their intervals wider and unequal, on the middle and lower half of each whorl, the sutural band above being generally smooth. Aperture broadly ovate, outer lip thin.

Length 4 mm., diameter 1.7 mm.; 6 whorls.

This species is quite abundant in the La Cira hematitic sandstones where it occurs with *Corbula abundans* and *C. magdalensis*. Like the *Corbula*s, the surface of the shell is generally damaged when the rock is broken. The sculpture varies from nearly smooth shells to others quite strongly marked with revolving threads. In some cases the thread about the middle may be quite strong, so that the whorl appears slightly carinate or angled.

### CERITHIIDAE

#### POTAMIDES Brongniart

**Potamides mcgilli**, new species. Plate 2, fig. 1.

Los Corros formation: locality No. 300, Rio Colorado, Colombia. Type 13096 A.N.S.P., collected by A. K. McGill.



The diameter of the turritid shell is contained about 2.6 times in the length. The earlier whorls are only moderately convex, but the convexity increases with growth, the last two being somewhat excavated below the suture, swollen and prominent in the peripheral region. Sculpture of smooth, protractively axial folds on the spire, but on the last two whorls, the spiral concavity segregates the upper end of the folds as small tubercles, and three spiral cords appear in the peripheral region, stronger where they pass over the axial folds. The base has about 6 small spiral cords. The inner lip seems to have a rather heavy parietal callus; characters of the aperture otherwise unknown.

Length 44 mm., diameter 17 mm.; 8 or 9 whorls.

We have found no comparable species, and in the absence of information about the apertural features, this species is referred to *Potamides* in the wide sense. This species occurs with *Diplocyma wheeleri* at the type locality.

#### DIPLOCYMA, new genus

Potamidinae with a smooth early stage followed by sculpture of somewhat protractive axial folds, which on the later whorls are more or less deeply interrupted, forming two spiral series of tubercles; the last whorl with spiral cords on the base. Lip sinuous, advancing in the lower part; inner or parietal lip heavily calloused throughout. Basal sinus shallow (?).

Type *D. wheeleri*, n. sp.

These forms do not seem referable to any of the known Potamidine subgenera or genera. It appears best to make a new genus for such characteristic shells.

**Diplocyma wheeleri**, new species. Plate 2, figs. 2, 3, 4.

Los Corros formation: 80 meters North, 40 West from the mouth of Quebrada Cabazoneras, a branch of Rio Sogamoso. Type 13095 A.N.S.P., collected by A. K. McGill. Also at Locality No. 300, Rio Colorado, collected by A. K. McGill.

The shell is solid, pyramidal, the diameter about half of the length. The apices are broken. An undetermined number of whorls appear to be smooth, protractively axial folds then appearing; on the last 2 or 3 whorls the folds are impressed midway between sutures, or suture and periphery on the last whorl, leaving them prominent above and below. The base has some irregular folds, about 4 spiral cords, and a basal ridge or fasciole. The growth lines are slightly retracted above, and on the last whorl broadly advancing in the lower half. The aperture shows the characters mentioned in the generic description. The outer lip is broken in all seen.

Length 45 mm., diameter 24 mm.; 6 whorls remaining.

In the largest specimen, selected as type, the nodes of the subsutural series are conerescent into an undulating spiral ridge, and a secondary cord revolves below it. In others, the nodes are not so connected. In immature stages this shell has a rather short, flattened base and angular periphery, somewhat as in *Lagunitus peruvianus* ("*Telescopium*" *peruvianum* Wood).

**Diplocyma sucionis**, new species. Plate 2, figs. 5, 6, 7.

Los Corros formation: Rio Sucio which is a branch of the Rio Llano, southeast of Infantas. Type 13093 A.N.S.P., collected by A. A. Olsson and E. La Tour. Paratypes in Olsson collection.

Smaller than *D. wheeleri*, and a little more slender. Early whorls smooth, followed by about 4 whorls with protractively axial, rounded folds, somewhat curved. A spiral depression then sets in, becoming very strong on the last 2 whorls, which thus appear to have two spiral series of tubercles, those of the superior series more or less conerescant into a ridge in some examples. The base shows a spiral cord below the peripheral series of tubercles. The lines of growth arch forward anteriorly. The inner lip is heavily calloused, the apertural characters otherwise unknown. The length is about 40 mm.

This species differs from *D. wheeleri* chiefly by the much more pronounced tubercles of the later whorls. In this feature it is like "*Tympanotonus*" *lagunitensis* Woods of the Peruvian Upper Eocene, which appears to be very closely related. The known examples of the Peruvian species are very poorly preserved but it appears to differ constantly from our form by the decidedly narrower contour of the cone, by its more regularly formed tubercles, and in having the two peripheral cords much more perfectly developed.

The specimen selected as type on account of the perfection of its sculpture, fig. 6, is somewhat flattened. Fig. 7 shows the normal form. Another specimen has about 4 basal cords and one between the two series of tubercles on the upper surface (fig. 5).

## MELANIIDAE

### HEMISINUS Swains.

For the purpose of this paper we are using the following arrangement of *Hemisinus*. It should be mentioned that various other characters of the shell may turn out to be of importance, such as the curvature of the lip and the development of the basal notch. Moreover, smooth forms may have resulted from degeneration of sculpture in different phyletic lines.

Shell smooth. Section *Hemisinus* proper. *H. lincolatus* (Gray).

Shell spirally grooved or corded. Section *Basistoma* Lea. *H. edwardsi* (Lea).

Shell with spiral cords or grooves and axial folds or ribs.

Whorls rounded, shell elongate. Section *Longiverena*, n. sect. *H. tuberculata* Spix.

Whorls carinate, shell stout in figure. Section *Verena* H. and A. Adams. *H. crenocarina* Spix.

**Hemisinus sigmachilus**, new species. Plate 2, figs. 10, 10a, 11.

Mugrosa formation: Rio Llano, Block 10S.-11E. Sta. 44. Type 13091

A.N.S.P., collected by A. A. Olsson and E. La Tour. Also in core from Well 660, depth 1803-1815 ft., and many other localities.

The shell is oblong-conic, the diameter somewhat less than half of the length; whorls but slightly convex, smooth except for weak lines of growth which have a reversed S trend, being retracted in a rather deep bay between suture and periphery, then arching broadly forward, much as in *H. edwardsi* (Lea). There is a more or less marked contraction or concavity immediately below the suture, which in crushed specimens may appear as a distinct margination of the suture. The aperture is ovate, the columella moderately thick, characters of the base not distinctly shown.

Length 20.5 mm., diameter 11 mm.,  $3\frac{1}{2}$  whorls preserved.

This abundant form is represented mainly by more or less crushed specimens, but the rather stoutly conic shape, smooth surface, and very strongly sigmoid lines of growth make it easy to recognize. At the type locality it is associated with *Hemisinus mugrosanus*.

A smooth species probably belonging to *Hemisinus* has been described as *Melanella karsteni* F. M. Anderson,<sup>1</sup> from the Guadas beds, in the eastern border of the upper valley of the Magdalena. These beds contain also "*Ampullaria*" and *Corbula*, and are considered by Anderson to be probably Eocene. This shell indistinctly shows sigmoid lines of growth curved as in *H. sigmachilus*, being advanced in a broad curve in the lower part, as in the diagrammatic figure from the type, Plate 4, fig. 9. The type specimen is broken at both base and apex. The seven whorls are almost flat, the last two being very slightly prominent below the suture. It measures, length 10.5 mm., diam. 4.7 mm. An enlarged outline of the type is given, Plate 4, fig. 9, one of the lines of growth indicated.

**Hemisinus (Basistoma)orrosensis**, new species. Plate 2, figs. 8, 9.

Los Corros formation: Rio Sucio, a branch of Rio Llano. Type 13092 A.N.S.P., collected by A. A. Olsson and E. La Tour. Paratypes in Olsson collection.

The shell has the general shape and appearance of the Recent *H. brasiliensis* Moric. The spire is straight-sided, the whorls being only weakly convex. Sculpture of spiral cords separated by narrower intervals. In the type, the upper two cords are wider than the others, but in other specimens all are about equal. In the type there are 5 spiral grooves on the penult whorl, but other specimens have 6. The aperture is ovate, slightly effuse at the base. Outer lip weakly reversed-sigmoid.

Length 29 mm., diameter 11 mm. 5 whorls remaining.

<sup>1</sup> Proc. Calif. Acad. Sci. (4), vol. 17, 1928, p. 23, pl. 1, f. 21, 22; cf. also p. 12.

*Melanella* was used by Anderson in the sense of Swainson for this melanian, but its smooth surface and sinuous lip differentiate it from "*Melania*" *hollandri*, the type of that European genus, now called *Amphimelania*. Until specimens of *M. karsteni* are found showing the base of the columella and thus giving ground for a definite generic reference, the species may better be called *Hemisinus* (?) *karsteni*.

This fossil appears to be a typical *Basistoma*, agreeing closely with the Recent species. Associated at the type locality with *Diplocyma suctionis*.

**Hemisinus (Longiverena) mugrosanus**, new species. Plate 3, fig. 1.

Mugrosa formation: Rio Llano. Type 13087 A.N.S.P., collected by A. A. Olsson and E. La Tour. Paratypes in Olsson collection.

The conic shell is straight-sided, the diameter contained about 2.4 times in the length. The whorls are flat but joined by a deeply impressed suture. Sculpture of axial ribs, which are rounded and about equal to their intervals, somewhat curved, being retracted a little below the suture, then advancing and gradually disappearing at the periphery of last whorl; on the last half turn there are about eleven ribs. Spiral sculpture of grooves cutting the ribs more deeply than the intervals, 5 on the penult whorl of the type, the lowest groove wider. The lines of growth have a reversed sigmoid trend, advancing in a broad curve on the base, retracted somewhat near the suture. The aperture has the narrow basal spout of *Hemisinus*. Columella moderately thick.

Length 18.6 mm., diameter 9 mm.;  $4\frac{1}{2}$  whorls remaining.

This species belongs, apparently, to the group comprising the Recent *H. tuberculatus* (Wagn.) and several Oligocene Antillean species, such as *H. costatus* and *H. bituminifer* Cooke of Cuba, *H. atriformis* Cooke and *H. siliceus* Brn. and Pils. of Antigua. All of these differ from the Colombian forms in details of sculpture.

**Hemisinus (Longiverena) eucosmius**, new species. Plate 3, fig. 2.

Mugrosa formation: from Well 660, depth 1803-1815. Type 13088 A.N.S.P.

Related to *H. mugrosanus*, but the whorls are noticeably more convex. Rounded, slightly protractive ribs, each of which bears four tubercles. On the last whorl, the ribs terminate at the periphery; at their ends there is a spiral cord, with a much weaker one below it, the base otherwise smooth. The faint lines of growth are but weakly sinuous. Aperture concealed.

Length 12.3 mm., diameter 5.6 mm.; 3 whorls remaining.

The smaller number of spirals and the distinct tuberculation of the ribs distinguish this species from *H. mugrosanus*.

**Hemisinus (Longiverena) lapazanus**, new species. Plate 3, figs. 3, 4.

Mugrosa formation: near El Centro, Square Mile 16S, 8E. Type 13090 A.N.S.P., collected by O. C. Wheeler.

Shell rather slenderly conic, the whorls strongly convex, suture deep. Axial sculpture of protractive curved ribs, about 15 on the last whorl, where they terminate at the periphery; each rib bears three tubercles, these have the appearance of being connected by low spiral cords, which are weak or obsolete in the intercostal valleys. Below the terminations of the ribs on the last whorl there are two spiral cords. Columella somewhat calloused.

Length 14 mm., diameter 7 mm.;  $4\frac{1}{2}$  whorls preserved.

The rather strong convexity of the whorls and the details of sculpture differentiate this from *H. eucosmius*.

**Hemisinus (*Longiverena*) *hopkinsi***, new species. Plate 3, fig. 8.

Mugrosa formation: near El Centro. Type 13089 A.N.S.P., collected by O. C. Wheeler.

The long-conic shell is composed of rather convex whorls joined by a well-impressed suture. Axial sculpture of slightly protractive ribs about equal to their intervals, about 19 on the last whorl, where they terminate at the periphery. Each rib bears 5 tubercles, the upper ones close below the suture. On the base there are two smooth spiral cords below the termination of the ribs (and perhaps some other lower spirals).

Length 15 mm., diameter 7.5 mm.; 5 whorls preserved. Sometimes larger, up to 20 mm. long.

**Hemisinus (*Longiverena*) *laciranus***, new species. Plate 3, fig. 5.

La Cira formation: near La Cira, Square Mile 1N-9E. Type 13078 A.N.S.P., collected by O. C. Wheeler.

A species resembling *H. eucosmius* but differing in details of sculpture; the curved axial ribs are weak, hardly reaching the periphery, each bearing tubercles where they are intersected by three low spiral cords. A fourth spiral cord, at the anterior termination of the ribs, is not tuberculate through a trifle uneven; it is followed by a lower cord, the rest of the base being smoothish. Lines of growth are weak and with a strongly reversed-sigmoid trend. The whorls are rather convex.

Length 11.5 mm., diameter 7 mm.; 3 whorls preserved.

In *H. eucosmius* there are four tubercles on each rib, the upper one as far from the suture as from the second tubercle. In *H. laciranus* there are only 3 tubercles on each rib, and the upper one is close to the suture.

**Hemisinus (*Longiverena*) *waringi***, new species. Plate 3, fig. 9.

La Cira formation: near Zopffs. Type 13072 A.N.S.P., collected by W. W. Waring.

The shell is slender with slightly convex whorls. Axial sculpture of slightly curved, protractive ribs which are narrower than their intervals, and cut into tubercles by spiral furrows. These are weak in the intercostal intervals. The upper furrow is somewhat deeper than the rest, reminding one of *Terebra*. There are four tubercles on each rib (or five by splitting of the lower series). The ribs terminate at the periphery of the last whorl, where there is a smooth spiral cord, followed by a much weaker one, the base otherwise smooth. Lines of growth reversed-sigmoid.

Length 14 mm., diameter about 5 mm.; 7 whorls preserved.

This species is known only by molds, the figures being from squeezes. It is more slender than *H. laciranus* and the details of sculpture differ. Named for W. W. Waring, Resident Geologist at El Centro.

**Hemisinus (?) gracillimus**, new species. Plate 2, fig. 12.

La Cira formation: 7700 N-4600 W., Station west of Zopffs. Type 13073 A.N.S.P., collected by W. W. Waring.

The shell is extremely slender, of numerous, straight-sided whorls and with a small, blunt apex. Whorls about 10 in number between sharp, distinct sutures. Surface is nearly smooth, only the last whorl showing 2 or 3 weak spirals below the suture and wrinkle-like folds back of the lip. At the periphery there is another cord, or it may be only weakly subangulated. The base is short, rounded to slightly flattened, smooth except for weak axial wrinkles (which are represented too strong in the figure).

Length 16.5 mm., diameter 5 mm.; about 10 whorls.

We have practically no clue to the generic place of this species. It appears to be too slender for *Pachychilus*. It is narrower than "*Melanella*" *karsteni* Anderson,<sup>2</sup> a smooth species from near San Juan de Rio Seco, east border of the upper valley of the Magdalena River, Colombia.

**Hemisinus (Verena) avus**, new species. Plate 3, figs. 6, 7.

La Cira formation: near Zopffs, La Cira district. Type 13071 A.N.S.P., collected by W. W. Waring.

The shell resembles the Recent *H. crenocarina* (Moric.) in general form but is much smaller. The turritid spire is moderately produced, the last 3 whorls at least being strongly angular, sloping and somewhat concave above the angle, vertical below it. Axial sculpture of rather irregular and not very strong folds which are slightly protractive, and on the shoulder above the keel are represented by uneven wrinkles. Below the shoulder keel there are also spiral cords, three on the penult, about 7 or 8 on the back of the last whorl, where they are separated by intervals at least equal to the cords. The lines of growth have a moderate reversed-sigmoid trend. The aperture is not shown.

Length 12 mm., diameter 7 mm.; 4 whorls remaining.

This snail appears to possess all of the main characters of the Recent *H. crenocarina*, the type of the subgenus *Verena*, and may be in or near the ancestral line of that group. *H. laevicarina* seems to represent a collateral line in which axial sculpture has disappeared. *H. avus* appears to be highly variable. In some examples the axial ribs are practically obsolete. In one individual there are 12 spiral cords on the last whorl. The most aberrant form is that represented in fig. 6, in which the last whorl has many strong, close axial folds which are tubercular at the intersections of the spiral cords. There are two examples of this strongly sculptured form.

**Hemisinus (Verena) laevicarina**, new species. Plate 3, figs. 10, 11, 12.

La Cira formation: Rio Oponcito, near Guanabanas, Colombia. Type 13079 A.N.S.P., collected by A. A. Olsson and E. La Tour. Paratypes in Olsson collection.

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<sup>2</sup> Proc. Cal. Ac. Sci., vol. 17, p. 23. 1928.



The shell has the general shape of *H. crenocarina* (Moric.) except that the spire is longer, and the carina is even. It is much smaller. The spire is turritid, the whorls carinate above the middle, the shoulder above the keel sloping, with a spiral impression and strong lines of growth. The keel is narrow and even. Below it the last whorl has about 8 spiral cords separated by narrow grooves. The aperture is shaped about as in *H. crenocarina*, and has an equally distinct basal sinus.

Length 17.5 mm., diameter 11 mm. (as broken).

In one individual there is a second keel below the usual one. The prominence of the spiral cords is quite variable but in fig. 12 they are largely worn off. None of the specimens show the spire entire.

It appears to be an abundant species at the type locality where it occurs with *Mytilopsis cira* and naiades.

**Hemisinus** species(?).

Besides the species described above there is another species represented by fragmentary molds only. It is unique by the sculpture of protractive ribs, narrower than their intervals, and *without spiral cords or grooves*. It is of rather slender shape, about 15 mm. long. The specimens come from the La Cira formation exposed in the cuts along the railway near La Cira.

## MUTELIDAE

### TRIPLONDON Spix

**Triplodon latouri**, new species. Plate 5, figs. 3, 4, 5.

La Cira formation: base of La Cira formation near Guanabanas on the automobile road. Type 13080 A.N.S.P., collected by E. La Tour. Also on the Rio Oponcito near Guanabanas, collected by A. A. Olsson and E. La Tour.

The shell is moderately plump, the diameter nearly half of the length, somewhat trapezoidal, with weakly arched dorsal margin; rounded anteriorly; posterior margin straightened, sloping steeply, basal margin moderately convex. Sculpture of radiating ridges which converge to form Vs in the middle of the sculptured area, and on each side of it about 7 or 8 ridges not meeting; the whole extending from one-third to one-half of the whole height of the valve. Below the sculptured portion the surface has only low wrinkles of growth.

Length 18.5 mm., altitude 14.6 mm., diameter 9.1 mm. (type).

Length 24 mm., altitude 19 mm. (largest paratype).

In some individuals there may be slight interruptions of the radial ribs on the sides of the sculptured area, producing a slight appearance of tuberculations, barely noticeable unless looked for closely. In one specimen which we provisionally refer to this species the anterior part of the sculptured area is broken into tubercles. This shell has been crushed nearly flat.

This is a plumper clam than *Ecuadorea bibliciana* Marshall,<sup>3</sup> and it does not show the cordlike flutings of the posterior area described for his genus and species. "*Hyria*" *wheatleyi* Marshall, a recent species of the Rio Negro, appears to be the most nearly related form, the outline and ornamentation being nearly the same. "*Hyria*" *wheatleyi* and *T. latouri* are far from being typical members of *Triplodon* (*Hyria* auct.), as they are not at all alate anteriorly and the posterior wing is only very weakly developed. Possibly both are referable to Marshall's genus *Ecuadorea*, which has the sculpture of *Triplodon* and the outline of *Diplodon*.

#### DIPLODON Spix

**Diplodon (Rhipidodonta) oponcitonis**, new species. Plate 4, figs. 1, 2, 2a.

La Cira formation: Rio Oponcito, near Guanabanas, Colombia. Type 13086 A.N.S.P., collected by A. A. Olsson and E. La Tour.

The shell approaches a circular form but is a little longer than high; compressed, moderately thick. The anterior end is rounded, the posterior obliquely, steeply truncate, a little produced at the post-basal extremity; basal margin moderately convex; dorsal margin well arched. The surface is marked with fine and coarse wrinkles of growth. Beaks eroded, showing no special sculpture. The hinge is rather strongly developed; cardinal teeth stout; laterals curved, contiguous and rather thin and sharp in the left valve, single and rather thin in the right.

Length 43.5 mm., height 37 mm. Type.

Length 43 mm., height 35.5 mm. Paratype.

The entire specimens of this clam are all more or less flattened, but a broken valve which apparently preserves the natural outline is about as convex as *Diplodon rotundus* (Wagn.). The cardinal teeth of the fossil are shorter and relatively stouter than in that living species. The conspicuous oblique sulcus and ridge seen on the posterior-dorsal slope of these clams is the result of compression, the lateral teeth and hinge-plate lying under the ridge.

#### MONOCONDYLAEA d'Orbigny

**Monocondylaea (?) marshalliana**, new species. Plate 4, fig. 3.

La Cira formation: Rio Oponcito, near Guanabanas, Colombia. Type 13085 A.N.S.P., collected by A. A. Olsson and E. La Tour.

The shell is plump, shortly trapezoidal, the anterior end rounded, the posterior wider, steeply truncate, basal margin moderately convex; posterior ridge rounded. Sculpture of coarse, unequal concentric wrinkles. Interior unknown.

Length 33 mm., height 26 mm., semidiameter 7 mm.

The external form is that of the shorter species of *Monocondylaea*, such as *M. parchappii* (Orb.). As both of the specimens found are in a very

<sup>3</sup> Proc. U. S. Nat. Mus., vol. 82, art. 5, p. 5. 1932.

hard matrix, we are unable to examine the hinge to ascertain whether only cardinal teeth are present, as in *Monocondylaea*, or laterals also, as in *Diplodon*. It is named for William B. Marshall, author of many papers on recent and fossil fresh-water mollusks of South America.

#### ANODONTITES Bruguière

**Anodontites laciranus**, new species. Plate 5, figs. 1, 1a.

La Cira formation: Rio Oponcito, near Guanabanas, Colombia. Type 13084 A.N.S.P., collected by A. A. Olsson and E. La Tour.

The shell is compressed and wide, the diameter being about 43 percent of the length, the height about 75 percent of the length; moderately thick. The anterior end is rounded, posterior end produced, basal margin strongly convex in the middle. Beaks rather prominent. Sculpture of faint growth lines, and in the ventral fourth coarse wrinkles of growth and growth-rests. The hinge plate is rather wide and short.

Length (estimated) 76 mm.; height 57 mm., semidiameter 16 mm.

This is a solid species, very much like *A. patagonicus* (Lam.), but wider in contour. The left valve collected had been shattered, and the anterior end is wanting. The epidermis is largely preserved.

#### CORBICULIDAE

##### SOGAMOSA, new genus

Shell similar to *Polymesoda* externally; hinge broad, with three divergent cardinal teeth in each valve; no lateral teeth on the flat hinge plate.

We are uncertain as to the systematic place of this peculiar clam, but temporarily refer it to the family Corbiculidae. The dentition has some resemblance also to that of some Donacidae, such as *Iphigenia*. Whether a pallial sinus is present could not be observed.

**Sogamosa cyrenoides**, new species. Plate 4, figs. 4, 5, 6, 7.

Los Corros formation: 80 meters North, 40 West, from the mouth of Quebrada Cabazoneras, branch of Rio Sogamoso, Colombia. Type 13094 A.N.S.P., collected by Mr. A. K. McGill. Paratypes in Olsson collection.

The shell is plump, subtriangular, about as high as long, moderately solid. The hinge-line is strongly arched. The prominent beaks are in front of the middle, contiguous and turned forward. No lunule or escutcheon present. Posterior ridge obtusely subangular. Sculpture of fine, rather short, concentric striae. Hinge-plate broad, each valve with three divergent cardinal teeth and no laterals. In the left valve, the anterior cardinal is highest, wedge-shaped, the posterior lowest and near to the middle tooth. In the right valve, the middle tooth is largest, stout and separated by a wide socket from the low, curved, posterior tooth. The anterior right cardinal is long and narrow. The flat hinge-plate behind the cardinals is rather long, tapering posteriorly, with no trace of a lateral tooth. In

front of the cardinals it is short and toothless. Muscle and pallial impressions not seen. The ligament is short and external, its limit marked by an impressed line.

Length 21.5 mm., height 23 mm., semidiameter 9 mm.

Length 26 mm., height 23.5 mm.

In external characters this clam is very much like *Polymesoda*, the Venezuelan *P. arctata* (Desh.), for example. It differs by the relative proportions and spacing of the cardinal teeth, and especially by the entire absence of lateral teeth. These shells were in an extremely hard but quite friable matrix containing also *Diplocyma wheeleri*, *D. sucionis* and *Hemisinus corrosensis*, and crowded with shell fragments. The association suggests estuarine or brackish-water conditions.

### DRIESSENIIDAE

#### MYTILOPSIS Conrad

**Mytilopsis cira**, new species. Plate 5, fig. 2.

La Cira formation: Rio Oponcito, near Guanabanas, Colombia. Type 13082 A.N.S.P., collected by A. A. Olsson and E. La Tour. Paratypes in Olsson collection.

Shell of an average oblique length of 20 mm., mytiliform, with a sharply angled, umbonal ridge and a wide, straight dorsal margin. The outline is somewhat variable, but usually in well-preserved shells the length is a little greater than the height, with the dorsal and posterior sides of the valves straight, and meeting to form a right angle. The anterior submargins are excavated, flattened to slightly convex, with a straight or a slightly bulging margin which joins with the dorsal margin at an angle of about 45 degrees. The beaks are small, terminal. The umbonal ridge is at first high and sharp, but becomes less angled and flattening below the middle. Hinge typical, with a wide septum and a small myophore in the dorsal side of the beak cavity. Surface with irregular lines of growth.

Length 16.75 mm., height 14 mm., semidiameter 4.25 mm.

Length 18.25 mm., height 16.50 mm., semidiameter 6.25 mm.

This species is fairly common in the La Cira fossil horizon on the Rio Oponcito, where it occurs with *Hemisinus laevicarina*, *Ostomya colombiana*, and several naiades.

### CORBULIDAE

#### CORBULA Bruguière

**Corbula (Corbula) abundans**, new species. Plate 2, figs. 13, 14.

La Cira formation: near Zopffs, La Cira district. Type 13077 A.N.S.P., collected by W. W. Waring. Also at many other localities near La Cira.

Shell small, generally about 6 mm. long, subequivalve, nearly equilateral and quite convex. The umbones are a little anterior of the middle with the

small, slightly coiled beaks touching at the tips. The left valve is a little more inflated than the right. The anterior margin of each valve is straight, descending, becoming rounded at the end; the posterior end somewhat longer, cuneate to narrowly truncated at the end. Ventral margin broadly rounded, the right valve showing a bulge on the posterior side of the middle, this bulge extending upwards across the umbones as a slightly more vaulted zone. The left valve has a weak, posterior-umbonal angle but less marked on the left valve. Surface smooth or marked only with weak lines of growth and deeper wrinkles. On the type, the left valve has three small radial threadlets showing on the lower half of the valve. Interior unknown.

Length 6.3 mm., height 4.5 mm., diameter 3.2 mm.

This is the most common species in the La Cira formation and occurs with *Corbula magdalensis*, packing hard layers of greenish sandstones or in deeply weathered oolitic and hematitic ironstones; in the later case, the fossils occur simply as internal moulds and impressions of the exterior. It is commonly associated with *Potamopyrgus laciranus*, *Hemisinus avus* and *H. waringi*.

*Corbula cebada* Anderson from near the base of the "Guadas group", upper valley of the Magdalena, resembles this species rather closely, but the more convex valve is not so plump and lacks the concentric waves which characterize *C. abundans*. The type of *cebada* is somewhat larger, measuring, length 6.8 mm., alt. 5.3 mm., diam. 3.7 mm. *Corbula hettneri* Anderson<sup>4</sup> is a much larger clam, peculiar in its short, triangular shape, sharp posterior angle and flattened posterior end. *Corbula scheibei* Anderson<sup>5</sup> is a short, plump species with broadly rounded beaks, length 11.6 mm.

***Corbula (Erodona) ? magdalensis*, new species.** Pl. 4, fig. 8.

La Cira formation: near Zopffs, La Cira district. Type 13075 A.N.S.P., collected by W. W. Waring. Also at many other localities near La Cira.

Shell small, up to about 9 mm. in length. The left valve is crassatelloid in form, with the posterior end nearly three times as long as the anterior, and with the small, inconspicuous beaks situated near the anterior one-fourth. The left valve has a nearly straight, descending posterior-dorsal margin and a weakly rounded ventral margin; the posterior extremity is obliquely truncated. The posterior-umbonal slope is noticeably angled and clearly marked in the casts of the left valve. Right valve is somewhat more convex than the left. Surface smooth or marked only with growth-lines. Hinge structure not observed.

Length 7.3 mm., height 4.1 mm., semidiameter 1.2 mm.

Length 9 mm., height 5 mm., semidiameter 2 mm.

Generally larger than the last species and most readily distinguished by its larger, more *Crassatella*-like, left valve. It is not quite as common as the last species.

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<sup>4</sup> F. M. Anderson, 1928, Proc. Calif. Acad. Sci. (4), vol. 17, p. 24.

<sup>5</sup> Loc. cit., p. 25.

## OSTOMYA Conrad

*Ostomya colombiana*, new species. Plate 5, fig. 7.

La Cira formation: Rio Oponcito, near Guanabanas. Type 13083 A.N.S.P., collected by A. A. Olsson and E. La Tour.

The shell is small, shaped much as in *O. fluviatilis* (H. Ad.). The length is about twice the height; rather plump. Anterior end short and rounded, posterior end produced, subtruncate. Ventral margin contracted near the middle. Beaks moderately prominent.

Length 6.7 mm., height 3.3 mm., diameter 2.7 mm.

Fossil species of *Ostomya* are known from beds in eastern Peru doubtfully referred to Pliocene, and there is one Recent species in the Marañon.

## III. TERTIARY STRATIGRAPHY OF THE MIDDLE MAGDALENA VALLEY,

BY O. C. WHEELER<sup>6</sup>

The stratigraphy of the Middle Magdalena Valley is here considered under the following headings:

## Pre-Tertiary Rocks

Basement rocks. Girón series. Palmira series.

## Tertiary

Eocene: Umir formation. Lisama formation. Toro formation. Chorro series.

Oligocene: Mugrosa series. Colorado series.

Miocene: Real series; in La Cira Oilfields area; in Sogamoso-Oponcito Rivers area; in Opon River area.

Pliocene.

## Quaternary

Magdalena formation.

The Magdalena valley above El Banco, latitude 9° N. and 140 miles from the Caribbean Sea, occupies a great structural depression that dates back to the close of the Cretaceous period. This depression and its environs is between the eastern and central Cordilleras of the Andes mountain system, and was the site of deposition of a great thickness of nonmarine sediments in Tertiary times when it was probably connected with the open sea at El Banco where the western Cordillera now disappears. Below El Banco, the Tertiary section is dominantly marine, but above there is no conclusive evidence that marine conditions have prevailed since the close of the Cretaceous period, save for brief periods during the early Eocene when marine waters occasionally invaded the fresh or brackish-water embayment.

During Cretaceous time the central Cordillera was a land mass representing the strand line of the sea that stretched over much of eastern Columbia and Venezuela. Although other parts of Colombia were invaded

<sup>6</sup> Published by courtesy of Tropical Oil Company and by permission of Dr. O. B. Hopkins.



by the Cretaceous sea, they are of no particular importance in this connection. The development of the eastern range of the Andes which began at the close of the Cretaceous, resulted in the development of the long narrow basin between the two cordilleras in which the Tertiary sediments were deposited.

Most published accounts of the Tertiary geology of the region above the latitude of El Banco relate to the area near Bogotá, Honda, and Giradot, in what is known as the upper Magdalena area. Very little has appeared in print on the so-called middle Magdalena area, i.e., that between Honda and El Banco. It is with a part of that area that this paper is primarily concerned and, particularly, that between the Sogamoso and the Carare rivers.

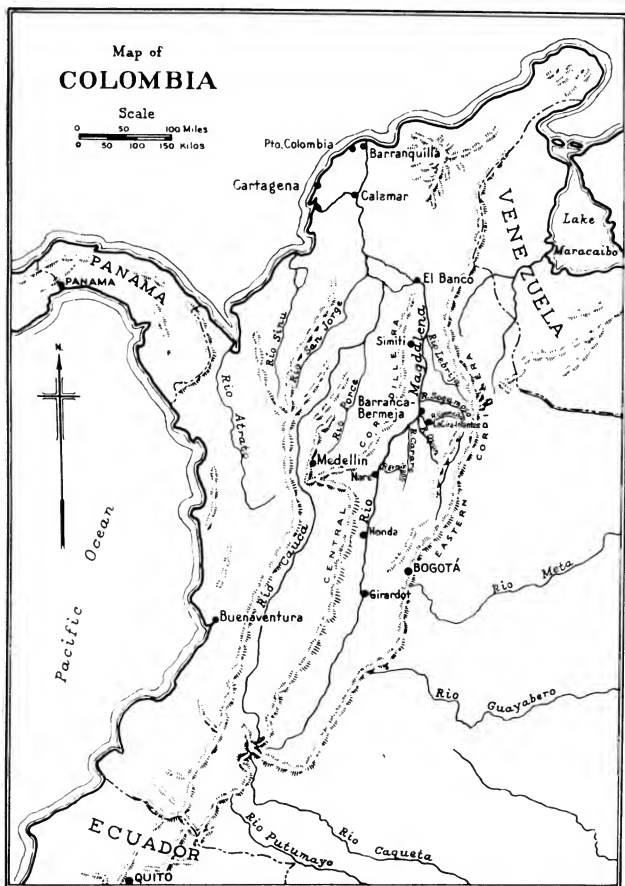
It was Karsten who first reported the presence of Tertiary sediments in the upper Magdalena region<sup>7</sup> and subsequently Hettner who classified the deposits of the same region in a broad sort of way into formational units on the basis of lithologic differences and structural breaks in the section.<sup>8</sup> Most investigators since the time of Hettner have followed, with modifications and refinements, his early classification; but the determination of the age of these deposits has been problematical on account of the absence of marine fossils and the scarcity of any other kind. The correlation of the sediments in different areas has likewise been difficult on account of the lack or scarcity of diagnostic horizons, lateral changes in character and thickness of beds, and of the complex structure of most localities in which these rocks are exposed.

On the east side of the Magdalena River there are three relatively thin but persistent fossiliferous horizons, carrying a characteristic fresh-water molluscan fauna, which have been an invaluable aid in the interpretation of the Tertiary geology of the region. These fossiliferous beds are known respectively as the Los Corros, Mugrosa, and La Cira fossil horizons. They are most commonly exposed in the regions between Sogamoso and the Carare rivers and have been traced 25 to 75 miles along the strike with only occasional breaks where they are cut out by faulting or buried by folding.

Through the studies of geologists working under the able direction of Dr. O. B. Hopkins on and near the Tropical Oil Company's De Mares Concession in the Magdalena valley between the Carare and Sogamoso rivers, much detailed information has been obtained during the past fifteen years on the geology of the Magdalena valley. Approximately 2000 square miles on and near the Concession have been mapped in more or less detail and, in addition, reconnaissance studies have been made over other parts

<sup>7</sup> Karsten, Hermann, "Géologie de l'Ancienne Colombie Bolivarienne", etc., Berlin (1886), p. 29.

<sup>8</sup> Hettner, A., "Die Cordillera von Bogotá", Petermann's Mitt. (1892), *Ergänzungsheft* 104.



of the valley and adjacent mountainous areas. Little has been done, however, in the region above the latitude of Honda. Wells drilled in search of petroleum have supplied fundamental data on parts of the valley area.

Geologists to whom credit is due for most of the basic data obtained in connection with investigations for the Tropical Oil Company include A. Iddings, B. J. Dining, M. B. Smith, D. McArthur, Earl Emendorfer, Theo. A. Link, A. K. McGill, W. W. Waring, J. L. Anderson, and P. A. Dickey.

Quaternary			Classification Used in this Report for Area Between Sogamoso and Carare Rivers	Fossil Horizons Sogamoso- Carare Rivers	Tentative Correlation with Upper Magdalena Section
	Pleistocene (?)		Magdalena		
Tertiary	Pliocene		Mesa		Mesa
	Miocene	Upper Middle and Lower	Real		Upper Honda
	Oligocene	Upper	Colorado	La Cira	Gualanday
		Middle and Lower ?	Mugrosa	Mugrosa	
	Eocene		Chorro	Los Corros	Barzalosa
		Upper	Toro		
		Middle (?)	Lisama		Guaduas
		Lower (?)	Umir		
Cretaceous	Palmira				Guadalupe Villeta

TABLE I. Classification of Tertiary Formations of Middle Magdalena Valley, and Tentative Correlation with section of Upper Valley

## PRE-TERTIARY ROCKS

The rocks that border the Tertiary embayment of the middle and upper Magdalena were the source from which the Tertiary sediments were derived. These border lands on the west side of the basin were the central Cordillera, and on the east, after the very early Tertiary, at least, the high cordillera of the eastern Andes. These eastern and western forelands are thought to have been long, relatively narrow peninsulas extending out from the mainland mass which probably extended south and east from the present drainage divide of the upper Magdalena and Amazon. Anderson was apparently of somewhat similar opinion as he states that, ". . . these deposits extend inland along valleys and among the mountains in a manner that suggests long, narrow inlets from the sea . . .".<sup>9</sup>

*Basement Rocks.* The central Cordillera which formed the western margin of the Magdalena Tertiary basin is composed of a series of pre-Cretaceous metamorphics represented by schists, phyllites, gneisses, quartzites, marbles, etc., and granites, andesites and other types of acidic igneous rocks. From graptolites found in shales or slates of this section near Puerto Berrio, the Ordovician age of some of these beds has been reported.

Gneissic and schistose rocks with some associated acidic igneous rocks constitute the core of the eastern Andes. They are exposed, however, only from about latitude 60° 40', longitude 73° W., northward and in some parts of the little-known region south of Bogota.

*Girón Series.* The Girón is a series of white, gray and red sandstones and shales, usually without fossils, that are perhaps 10,000 feet or more in thickness. They are the oldest unaltered sediments in the eastern Andes where they form much of the central part of the cordillera. No Girón is definitely known in the central Andes. The age of the series has been variously regarded as Lower Cretaceous, Jurassic, or even older.

*Palmira Series.* The Palmira series is a 7400 foot section of alternating black shales and dark gray to black limestones and black cherts of Lower and Upper Cretaceous age. The series rests on the Girón in the eastern Cordillera. East of the Magdalena river, the only known outcrops are in the valleys near Simití where the lower Palmira rests directly upon the old crystalline rocks.

The Palmira of the Tropical Oil Company geologists is the correlative of the Villeta and perhaps the Guadalupe of Hettner.<sup>10</sup>

<sup>9</sup> Anderson, F. M., "Nonmarine Tertiary Deposits of Colombia." Bull. Geol. Soc. Amer., Vol. 38 (1927), p. 593.

<sup>10</sup> Hettner, A., op. cit.

## TERTIARY

The Tertiary deposits in the middle and upper Magdalena basin represent the detritus derived from the drainage systems of rivers flowing from the central and eastern Andes into the intervening Tertiary basin. The rocks from which this waste was derived were those briefly described above.

At the close of the Cretaceous, the sea, which extended far to the east and northeast from the central Andes, withdrew until most, if not all, of the areas that had been submerged in eastern Colombia and Venezuela were above sea level. At the same time there was a slight elevation in what later became the eastern Andes and sufficient deformation of the Cretaceous over most of the area to produce an angular unconformity between it and the later deposited Tertiary. Between this uplifted area and the central Andes to the west there was developed the intervening Magdalena basin which continued to subside with occasional interruptions throughout Tertiary times. Within this basin there was deposited an alternating series of Tertiary sands and shales having a maximum thickness of at least 25,000 feet. This great series of sediments was entirely nonmarine with the exception of occasional intervals represented in the lowermost 3000 feet. The sediments were competent in volume, therefore, to exclude the sea, except at the beginning, despite the great subsidence that took place.

The eastern and western margins of this basin during most of Tertiary times can be determined only approximately. On the western side, Tertiaries of Miocene age are known to overlap the Lower Cretaceous near Simití and farther south, near Puerto Berrio and Mariquita, strata thought to belong to the Miocene rest upon the metamorphics.<sup>11</sup>

In the area about 5-8 miles east of Barranca Bermeja and about 25 miles east of the mountain front of the central Cordillera, it is found from drill holes that a 6900 foot section of Tertiary rocks ranging in age from Upper Eocene to Lower Miocene is present and that these rest upon the Cretaceous. This same 6900 foot section thickens to approximately 18,000 feet 12-14 miles farther east in the foothills of the eastern Cordillera and in addition there are several thousand feet of beds lower in the section that are missing in the wells mentioned. It is thus apparent that there is an overlap of younger beds on older from east to west in this area and that there is a great thickening of similar beds in the section toward the east.

The position of the eastern margin of the Tertiary basin is more obscure owing to late Miocene folding and faulting having resulted in the uplift and the erosion of almost the entire Tertiary section to the east of the foothills of the eastern Andes. The Tertiary shore lines were probably slightly west of the present crest of the eastern Andes and migrated westward with

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<sup>11</sup> Etherington, T. J., Personal Communication.

the progressive growth of the mountains and with the growth of deltas at the stream mouths.

The basin thus roughly defined on the east and west extended, as stated, for some distance south of Bogotá. To the north it was perhaps in very poor communication with the open sea through a narrow passage near El Banco, for at El Banco marine Miocene fossils are found; and from there coastward, the Tertiary section is dominantly marine. South of El Banco there is no known evidence of marine conditions except in the lower part of the Eocene represented.

The Tertiary section as represented and defined on the Tropical Company's Concession is indicated on the accompanying Table I. The correlations with the section of the upper Magdalena area appear to be as logical as can be made at this time, but should be considered as tentative.

#### EOCENE

*Umir Formation.* The depositional cycle that followed the retreat of the Cretaceous sea was initiated by the submergence of the Magdalena basin and no doubt much of what is now the eastern Andes. A series of 3000-4000 feet of dull blue and bluish-black rather well-bedded carbonaceous shales were laid down, which in the upper 1000 feet or so, are interstratified with coal beds up to a few feet in thickness and with very thin beds of hard, fine-grained, greenish and brown ripple-marked sandstones and thin lenses of clay ironstone. These beds are called the Umir formation. One thin stratum in the formation is known to carry marine mollusks. In other parts of the section there are occurrences of pelagic Foraminifera in shales alternating with coal beds.

*Correlation and Age.* The age of the Umir has not been definitely established but the best evidence available indicates it as Eocene. It was Anderson who first suggested that beds embraced within the Umir belong to the Eocene when he correlated them with the Guaduas of the upper Magdalena area, but he submitted no convincing paleontological evidence to establish either of these series as Eocene.<sup>12</sup> Quite recently, however, Olsson examined a small collection of poorly preserved material from the middle part of the Umir and reported that <sup>13</sup> "No distinctive Cretaceous genera were found. On the other hand, most of the species belong to common Eocene genera such as *Trinacria*, *Venericardia*, *Mactra*, and *Rimella*. There is a strongly carinated or keeled *Turritella* which may be a young *T. mortoni*."

The Guaduas formation of the upper Magdalena area is a coal bearing series consisting of variegated shales, sandy shales, and sandstones resting

<sup>12</sup> Anderson, F. M., op. cit., p. 602.

<sup>13</sup> Olsson, A. A., Personal Communication

unconformably on the Cretaceous<sup>14 15</sup> and regarded as Eocene in age. The greater abundance of sandstone, the variegated colors of the shales and the presence of veinlets of gypsum, as reported by Scheibe, in the Guaduas, point to the deposits in the Bogota region as being the shallow water and more characteristically subaerial deltaic equivalents of the Umir formation.

The Third Coal Horizon of western Venezuela<sup>16</sup> would also be the correlative of the Umir.

*Lisama Formation.* The Lisama formation marks a transition in type of deposits between the well-bedded, dull bluish-black Umir shales, that were of alternating marine and nonmarine character in the middle part of the Magdalena basin, and the typical continental deposits of the remainder of the Tertiary section. The Umir beds have been seen to be rather well-bedded, dark-colored, carbonaceous shales with very little sand and with a considerable development of coal. The fineness of the sediments except in the upper reaches of the basin, give no indication of any marked relief in the forelands, and the alternation of coal beds and other continental deposits through at least 1000 feet of the section give evidence of only gentle oscillations in sea level.

With the advent of Lisama times, however, a 3500 foot series of beds containing much more coarse sediments were laid down. These consisted of beds of mottled shales, alternating with minor amounts of dull-colored carbonaceous shales, intercalated with occasional coal beds of much less notable development than those of the Umir, and brown, fine- and medium-grained well-bedded sandstones up to 25 or 30 feet in thickness. Whether an unconformity separates the Lisama from the Umir is not known, but it is very apparent that the uplift of the eastern Cordillera was more active than it had been during Umir times.

*Correlation and Age.* Only one fossil locality is known in the Lisama beds. This is near Las Cruces on the north side of the Sogamoso river. The fossils are almost completely disintegrated and it has not been possible to identify them. The position of this formation below the Los Corros fossil horizon of Eocene age and above the Umir, regarded as Eocene, makes it certain that it belongs to the Eocene. On account of the large unconformity that is present at the top of the Lisama, as will be referred to presently, the formation may belong to the Middle Eocene. In the coastal area of Atlantico, Colombia<sup>17</sup> and in Northern Peru<sup>18</sup> the major break in Tertiary sedimentation occurs between the Middle and Upper Eocene.

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<sup>14</sup> Karsten, op. cit.

<sup>15</sup> Scheibe, R., "Documentos de las Comisión Científica", Bogotá (1918), p. 176.

<sup>16</sup> Liddle, R. A., "The Geology of Venezuela and Trinidad." (Fort Worth, 1928), p. 180.

<sup>17</sup> Olsson, A. A., Unpublished Report.

<sup>18</sup> Olsson, A. A., "Contributions to the Paleontology of Northern Peru." Pt. 1, Bull. of Amer. Paleon., Vol. 14, No. 52 (1928), p. 8.

The Lisama formation is with little doubt, the correlative in part of the thick Guaduas formation of the Upper Magdalena.

*Toro Formation.* Following the deposition of the Lisama, there was an emergence above sea level of a large part of the Magdalena basin. The period of erosion that ensued was of sufficient duration to permit the partial or complete denudation of much of the subjacent Lisama. Near the Sogamoso River at Peña Cruces and near the mouth of Quebrada Putana, some 2500-3500 feet of Lisama beds are exposed. Fifteen miles south the formation is 700 feet thick, and about 8 miles farther south it is entirely missing. Going still farther south for another 6 or 8 miles, the formation is alternately present, in thicknesses up to a few hundred feet, and completely absent.

The Toro formation or "altered shale" as locally termed, is a hard, dense, gray to light grayish-blue, highly-joined shale that is usually massive, although occasionally extremely finely bedded. When well-bedded, it is usually a very light gray or pure white and is highly suggestive of a tuff. No glass, however, has ever been found in the rock. A small amount of siderite is sometimes present, and in the massive variety in particular, some mottling is occasionally noted.

The Toro is usually not more than 60 feet thick. It is highly resistant to erosion between the Sogamoso and Opon rivers and is a ridge-former of great assistance in field mapping. North of the Sogamoso, the formation becomes sandy and less resistant and soon disappears. It is not known south of the Opon River.

The Toro may rest either upon the Lisama or older formations, depending upon the magnitude of the unconformity that separates it from the underlying beds. It has been found on the unconformable surface of formations ranging from Palmira to Lisama in age.

The origin of the Toro is not clear. Whatever its origin, it had attained its marked induration shortly after deposition, as hard fragments of it sometimes form a basal conglomerate of the overlying formation.

*Correlation and Age.* The normal position of the Toro between beds classified as Eocene, places it in the same epoch. If the unconformity at the base of the Toro marks the close of the Middle Eocene, the Toro formation would be of Upper Eocene age.

*Chorro Series.* An unconformity, perhaps local and of short duration, marks the top of the Toro. It sufficed to permit at least partial removal of the Toro, however, for in one well a core of almost pure "altered shale" conglomerate was obtained directly upon the Toro itself. In some areas, the Toro is missing, but this could conceivably be explained by non-deposition due to strength of local bottom currents.



The Chorro series is that part of the section embraced between the Toro formation and the uppermost bed of the Los Corros fossil horizon. It is exposed only on the east side of the Magdalena River where it is found to change decidedly in character and thickness from west to east. In the La Cira oilfield, about 5 miles east of the Magdalena River, it has been cored in bore holes; and in the adjacent Infantas field it is exposed at the surface and has also been cored in wells. In those two fields the series is called the D- and C-Zones and consists of a lower 550 foot formation (D-Zone) of hard, massive, dull blue and brown-splotched shales with a small amount of interbedded gray fine-grained sandstones, and an upper 550 foot formation (C-Zone) of gray and brown, both fine and medium-grained, rarely coarse and pebbly, sandstones, intercalated with tough and hard mottled shales. The C-Zone is the most prolific oil-producing horizon yet discovered in Colombia.

The top of the Chorro at Infantas and La Cira is marked by several feet of dark gray to black thin-bedded carbonaceous shales and sandy shales. In other localities this member carries the so-called Los Corros assemblage of fossils which define the top of the Chorro, but here the fossils are missing. There can be little doubt, however, as to the identity of these beds on account of their position in the section with respect to beds of known age above and below and of the occurrence of diagnostic heavy mineral zones similar to those in the section where the Los Corros horizon is fossil-bearing.

The Chorro series thickens gradually to the east until the foothills of the cordillera are reached, where a notable thickness is present. Twelve miles southeast of Infantas, the Chorro is 1300 feet thick and consists of massive, dull blue and brown shales, fine sandy shale and fine-grained sandstones with a 30-50 foot series of hard well-bedded black shales and sandy shales carrying a Los Corros fauna marking the top. Six miles farther on to the northeast, it is 1450 feet thick and of similar character. Some 20 miles northeast of this locality, on the Sogamoso River near Quebrada Putana, it thickens to 3000 feet and from there to a point 8 miles upstream near Santa Marta, the thickness apparently attains the almost incredible amount of some 6500 feet. A part of this latter increase is doubtless only apparent and is due to the depositional dip resulting in an exaggerated indication of thickness in the measured section, but it is practically certain that a notable thickening does occur.

The lower 3000 feet of beds in the thick section at Santa Marta is called the La Paz sandstones by the Tropical geologists. These are massive, coarsely cross-bedded, pebbly and conglomeratic arkosic sandstones which form the La Paz range of low rugged mountains and which are well exposed in the gorge cut by the Sogamoso River.

Overlying the La Paz sandstones near Santa Marta is the Esmeraldas formation consisting of some 3500 feet of dull-colored mottled shales interbedded with a minor amount of well-bedded sandstones, that are usually fine-grained, and occasionally laminated with finely comminuted plant remains. At the top of the Esmeraldas, the Los Corros horizon of well-bedded black shales and sandy shales is well exposed and is abundantly fossiliferous.

Between the Minero and Ermitaño rivers, the Chorro series is again exposed<sup>19</sup> but the writer has never had the privilege of investigating it in that locality.

*Correlation and Age.* On the basis of evidence that is partly stratigraphic and partly faunal, Olsson suggests that the Chorro series belongs to the late Upper Eocene and is about equivalent to the Saman formation of Northern Peru, the late Jacksonian of the southern United States and the Ludian of Europe. As now understood, the Los Corros fauna is radically different from the succeeding Mugrosa in containing at least two (and possibly other) generic types peculiar to this formation. The interesting clam, *Sogamosa cyrenoides*, is generally very abundant and is apparently restricted to this formation. *Diplocyma* of which there are two species in the Los Corros, occurs also in the Saman of Peru where it is represented by "*Tympanotonus*" *lagunitensis* Woods, which is very closely related to the species described in this paper as *sucionis*. *Potamides mcgilli*, when more fully known, may probably also belong to a hitherto unrecognized genus. These faunal features give to the Los Corros assemblage, an Eocene rather than Oligocene aspect.

Marine Upper Eocene rocks are very widespread in the coastal region of Colombia as well as in northern South America in general, and were deposited during one of the most extensive marine transgressions of Tertiary times. It seems reasonable to believe that the nonmarine equivalent of these rocks should occur in the Tertiary embayments, as well exemplified by the deposits of the Magdalena valley.

In the Bogotá region Scheibe describes a formation which he calls the Barzalosa, consisting of variegated clays, sandstones and conglomerates which rest unconformably on the Guaduas.<sup>20</sup> On account of its unconformable relationship to the Guaduas and of its lithologic characteristics, the Barzalosa may be the Chorro equivalent. The evidence for such a correlation is, however, slight.

Species belonging to the Los Corros fauna of the Chorro series are enumerated at end of the introduction.

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<sup>19</sup> Max Steineke, Personal Communication, 1927.

<sup>20</sup> Scheibe, R., op. cit., pp. 174 and 177.

## OLIGOCENE

The base of a massive, tough, dull blue, brown and red-splotched shale that rests on the black Los Corros fossil-bearing shales is believed to represent the beginning of the Oligocene. The occurrence of these basal shales is so widespread that they suggest a regional subsidence of the basin at that time.

The Oligocene section is made up of two thick series of alternating sandstones and shales that have been designated the Mugrosa and the Colorado series. These have been subdivided into formations which are so variable in character that they often lose their identity within 5 or 10 miles. No attempt will, therefore, be made to describe in detail all the various formations of these series.

Within the section here regarded as Oligocene, there are two fossiliferous members called the Mugrosa and the La Cira fossil horizons. The lower of these is the Mugrosa fossil horizon, and it carries an abundance of gastropods belonging to the genus *Hemisinus* and some fish bones and teeth. It is from 1200 to 4500 feet above the Los Corros horizon depending on the distance from the foothills that the measurement is made. From faunal evidence, the Eocene-Oligocene contact might be placed anywhere between the Los Corros Eocene and the Mugrosa fossil horizons, but from lithologic and stratigraphic evidence there appears to be no good reason for placing it higher than is herein designated.

The La Cira fossil horizon occurs above the Mugrosa fossil horizon at an interval increasing progressively eastward from 2600 feet in the La Cira oilfield to 6900 feet in the foothills fifteen miles away. The La Cira fossils may be either Upper Oligocene or Lower Miocene in age.

*Mugrosa Series.* The Mugrosa series at Infantas and La Cira is 1200 feet thick and constitutes what is called the B-Zone. The lower B-Zone is a 700 foot section of dull-blue and dull-brown, massive, mottled shales broken by occasional relatively thin beds of fine-grained sandstone and light green sandy shales. The upper B-Zone is 500 feet thick and consists of gray fine to medium to coarse-grained, occasionally pebbly, sandstones interbedded with minor amounts of mottled shales. It is an important producer of oil in the two fields.

Eastward from Infantas, the Mugrosa formation thickens rapidly. A mile east of the field it is 1700 feet thick; 8 or 10 miles southeast it is 3500 feet thick and is more noticeably brown and red-splotched; and 15 miles east it is 4500 feet thick. Going east from Infantas there is an increase in the proportion of sand to shale in the part of the section corresponding to the lower B-Zone, but a reverse relationship exists in the correlative of the upper B-Zone.

The Mugrosa fossil horizon, which occurs at the top of the Mugrosa series, is variable in lithologic appearance. At Infantas the member is a shale from a few inches to perhaps 15 feet thick and is usually olive green or maroon in color, although it is sometimes black, brittle and very well bedded. When occurring in black shales, the fossils are usually perfectly preserved fragile shells; but in the maroon shales the original shells are destroyed with only the casts preserved and these are replaced solidly by calcite. In a few cases, oolitic glauconite has been noted to occur sparingly in the section. The association of the calcified casts of fossils with maroon-colored shales which, in their apparently unaltered condition are black, along with small amounts of glauconite, may signify a minor unconformity in the section.

In the foothills to the east, the Mugrosa fossils occur in shales similar to those at Infantas, although the beds are usually thicker, totaling as much as 25 feet in thickness. The fossils are abundant and are known to occur over a distance of 75 miles from the La Cira field almost to the Ermitaño River.

*Correlation and Age.* In the Mugrosa series we note a greater development of the river snails of the genus *Hemisinus*. Some of these species, as *H. mugrosana*, are closely related to the group of species of this genus described by Brown and Pilsbry, and Cook from the Antiguan Oligocene, and Cuba. It is believed that the Mugrosa series should be correlated with the Antiguan formation and, therefore, about Middle Oligocene in age. Undoubtedly additional collecting will add many more species to the Mugrosa fauna as many collections examined from this horizon contain very poorly preserved fossils which cannot be identified; those now known are listed at end of introduction.

*Colorado Series.* The Colorado Series is another alternate succession of shales and sandstones but differs as a unit from the underlying Mugrosa in that the shales are ironstained with brighter hues of red and that the sandstones markedly coarser and more conglomeratic.

In the Infantas-La Cira fields, the Colorado series attains a thickness of about 3300 feet. The lower 500 feet is called the lower A-Zone and consists mainly of shales broken by occasional streaks of fine-grained gray sandstones that are notably pyritic and often quite limy. Above these follow the middle A-Zone sands which are a 700 foot series of alternating gray, medium to coarse-grained pyritic sandstones, and vari-colored shales. Thin streaks of these sands are also limy. The middle A-Zone yields a small amount of heavy oil. Following above are the upper A-Zone beds which are gray and red-spotted shales interspersed with thin-bedded sandstones. These are 550 feet thick. A pebbly sandstone horizon, the Guamito formation, 350 feet in thickness, and an overlying series of

bright-mottled shales and coarse, gray sandstones 300 feet thick make up the rest of the series to the base of the La Cira fossil horizon or the La Cira formation. The La Cira formation is a 350 foot succession of dull gray to black well-bedded carbonaceous shales, varying from brittle to waxy, with which are interbedded light greenish-colored, medium grained sandstones of a few feet in thickness. The sandstones weather to a brown very resistant rock. Fresh and brackish-water mollusks occur in several distinct beds. Fragments of leaves also occur in the section.

Tracing the Colorado series eastward, we note the same increase in thickness that characterises the underlying Tertiaries. From 3-6 miles east of Infantas, the series attains a thickness of 5600 feet and 19 miles northeast it is 7700 feet thick. The series becomes increasingly sandy, with the exception of the La Cira formation, and the sandstones become increasingly pebbly and finely conglomeratic. The Guamito formation, which is 350 feet thick at La Cira is a pebbly and conglomeratic succession of beds apparently 2800 feet thick in the foothills section 15 miles east. The shaly parts of the section likewise increase in thickness but to a less notable degree.

*Correlation and Age.* The La Cira formation marking the top of the Colorado series is the thickest of the fossiliferous horizons. It is known only in the intermediate area between the Sogamoso and Opon rivers, but is perhaps buried over a much wider area in the Magdalena lowlands.

The La Cira fauna is the richest in the number of recognizable species and, in addition to those described in this paper, many others are indicated by material too poorly preserved for identification. The genus *Hemisinus* is well represented, and in addition to the cancellated *Longiverena* already known from the Mugrosa, we may note the introduction of members of the subgenus *Verena*, a group still living in the rivers of South America, and its first recognition as fossil. Among the small snails of the family Amnicolidae, there is a species of *Potamopyrgus*.

Among the naides, there are four species belonging to as many genera, all of which are represented in the recent fauna of South America. Probably the most interesting of these is the *Triplodon latouri*, fairly closely related to "*Hyria*" *wheatleyi* Marshall, a recent species of the Rio Negro.

In the La Cira, we find also a brackish-water element in the presence of two species of *Corbula* and one species of *Mytilopsis*. The Corbulae usually occur in great numbers in an oolitic ironstone which originally may have been glauconitic. In closely associated beds are species of *Hemisinus* and *Potamopyrgus* both of which are fresh-water molluscs. It thus seems that the waters were fresh but occasionally made brackish by tidal waters that had access to the region.

On the basis of stratigraphy, the La Cira formation cannot be older than the Upper Oligocene if the Mugrosa is correctly referred to the Middle Oligocene. The diversified La Cira fauna has a rather modern aspect in that all the genera with the possible exception of *Longiverena* belong to recent groups. The formation could be either Upper Oligocene or Lower Miocene in age, although from stratigraphic evidence alone, as will be referred to presently, it would perhaps be referred to the Upper Oligocene. Species belonging to the La Cira formation are listed at end of introduction.

#### MIOCENE

Resting on the La Cira formation, or, in its absence, upon lower beds, is a massive series of poorly sorted sandstones, that are commonly coarse and often conglomeratic, and reddish and brown-mottled clays called the Real Series and regarded as Miocene in age. The basal formation of this series in the upper Opon River area is a conglomerate consisting largely of brown chert cobbles and boulders up to 6 inches in diameter. In that area the underlying La Cira fossils are missing. In the foothills region to the north, however, and in the lower part of the valley near the La Cira-Infantas oilfields, the base of the series is a massive gray and markedly red-splotched clay which rests on the La Cira member. On account of these different relationships, it is believed that there is an unconformity in the section not far above the La Cira formation and that this unconformity marks the base of the Miocene. The strata regarded as Miocene are barren of molluscan fossils so far as is known, but they occasionally carry fossil leaves and some of these appear to be Miocene.

A characteristic of much of the sandy part of the Miocene section is the abundance of hornblende and, to a somewhat less degree, of magnetite. Strata belonging to the older epochs rarely contain any hornblende at all. The freshness of the hornblende and its abundance, indicate quite certainly that it was derived directly from the andesitic rocks to the south and southwest.

The Miocene in the foothills of the Opon and Guayabito river region attains the apparent thickness of 12,700 feet. Some 30 to 40 miles north, between the Oponcito and Sogamoso rivers, but also in the foothills, the thickness appears to be about 9000 feet. A great thinning of the section is also evident nearer the Magdalena River but to what proportion is not known owing to the cover of later deposits.

The thick development of Miocene sediments and the abundance of coarse clastics in the foothills section, particularly in the Opon-Guayabito area, reflects the increased intensity of the uplift of the eastern Andes which reached its maximum during this epoch.

*Real Series.* The Real series has been divided into eleven different formations between the Sogamoso and Carare rivers and might well be further subdivided. It is with considerable difficulty and uncertainty, however, that some of these formations are correlated. A brief description of the series will, therefore, be given in three representative areas.

*Real Series in La Cira Oilfield Area.* A 1400 foot formation of massive gray, maroon, and red and brown-splotched clays rests upon the fossil horizon of the La Cira formation. Toward the top, a small amount of platy selenite occurs in the shale fractures. The formation is practically devoid of sand except in the extreme upper part. It includes the so-called Peligrosa and Viscaina formations to the east.

Above the shales is a 300 foot formation consisting of dull brownish-green shales and silty sandstones carrying much magnetite and hornblende. This is the Nutria formation.

*Real Series in Sogamoso-Oponcito Rivers Area.* A massive, mottled gray, maroon, red and brown clay 1300 feet thick rests upon the La Cira fossil horizon. This is followed by 1000 feet of white, coarse, friable, cross-bedded sandstone with conglomerate lenses, broken by varicolored clay beds, and in turn by 2500 feet of green, gray and mottled clays and fine to medium-grained green and brown sands that usually carry considerable hornblende and magnetite. Thin partings and seams of lignitic material are occasionally present in the sands. Next in the section is a 4300 foot succession of massive, mottled gray, yellow, brown and red shales that are interbedded with a minor proportion of white, gray and occasionally green sandstones which may be pebbly. These are followed by at least several hundred feet of bright blue or greenish-blue, coarse grained and occasionally pebbly sandstones interlaminated with shales of similar color. This formation contains an abundance of magnetite and hornblende.

*Real Series in Opon River Area.* A massive, cross-bedded, pebbly sandstone with a 100 foot conglomerate at the base rests unconformably on the Colorado shale series in this area. Brown and black chert, clay-ironstone, coal fragments and quartz are the main constituents of the conglomerates and pebbles. A cement of limonite makes some of these beds, as well as some in the overlying formations, quite resistant. Gray, blue and mottled shales are interbedded with the sandstones. This formation is called the Lluvia and is about 1600 feet thick.

Above the Lluvia is a 4200 foot section of predominantly gray and red-mottled shales interbedded with thin beds of gray, cross-bedded, ripple-marked sandstones. This is called the Chontorales shale.

The Hiel formation consisting of 3500 feet of sandstones similar to those of the Lluvia formation overlies the Chontorales shales. The conglom-

meratic and pebbly beds contain less coal fragments than those of the Lluvia. Silicified and carbonized tree trunks are common.

The Enrejado shales overlie the Hiel formation. These are 1500 feet thick and are composed of gray, red, purple and brown-spotted shales and blue shales. Some thin beds of white, friable sandstone are interbedded.

The Bagre formation is the youngest of the Real formations and is made up of blue and greenish-blue cross-bedded sandstones that may be pebbly and conglomeratic. An abundance of carbonized wood and leaves and some silicified wood is present in the formation.

*Correlation and Age.* Fossil leaves from the Nutria formation were examined by Professor E. W. Berry who reported as follows: <sup>21</sup>

"The larger is a *Ficus* very close to or identical with *Ficus porcellanaria* Hollick, from the Caroni formation of Trinidad (Upper Miocene). The smaller appears to be a new species of *Cedrela*. Consequently the age indication is vague. As far as it is worth anything, it would indicate an Upper Miocene age."

The existence of a probable unconformity not far above the La Cira formation has been suggested as possible evidence of an Oligocene-Miocene break in sedimentation.

In the upper part of the Magdalena basin Stutzer reports that the Upper Honda and Gualanday (Lower Honda) formations are differentiated in that many beds of the Upper Honda carry andesitic material while this is completely missing in the Gualanday.<sup>22</sup> On that basis the Upper Honda would be the correlative of the Real Series, and the Gualanday of the Lower Honda would belong to the underlying Oligocene.

Stutzer again calls attention to the occurrence of petrified logs in the Upper Honda series near Nare and on the Upper Ermitaño.<sup>23</sup> As silicified logs have not been found in other parts of the section, we thus have further confirmation of the correlation between the Real and Upper Honda beds.

#### PLIOCENE

Following the period of Miocene sedimentation, the Magdalena basin emerged from below sea level and again became subject to erosion. During this interval of erosion and preceding what is considered the Pliocene submergence, the strata were considerably folded, and the overlying Pliocene beds, called the Mesa formation, were deposited nonconformably upon them.

The Mesa embayment was no doubt much more restricted than the previous ones of the Tertiary. Most of the former Tertiary sea bottom

<sup>21</sup> Private report to O. B. Hopkins, July 25, 1930.

<sup>22</sup> Stutzer, Otto, "Beiträge zur Geologie und Mineralogie von Kolumbien", N. Jahrb. für Mineralogie, etc., Beilageb, 52, Abt. B. (1926), p. 165 et seq.

<sup>23</sup> Stutzer, Otto, "Beiträge zur Geologie und Mineralogie von Kolumbien. XI. Zur Geologie des Mittleren Magdalenaales", N. Jahrb. für Min. etc., Beilageb. 57, Abt. B (1927), pp. 354-355.



was doubtless a land mass during Mesa times and has remained an area of erosion since the Miocene emergence.

The Mesa sea that inundated the valley was also fresh and was one of quiet and little-disturbed waters. A series of a thousand feet or more of rather well-bedded sands and andesitic tuffs were deposited, largely perhaps in what constitutes present lowlands of the upper and middle Magdalena valley of today. The tuffaceous character of the sediments is striking upstream from near La Dorada, where andesitic material is the main constituent of the formation.

Following the deposition of the Mesa, the waters withdrew from the valley for the last time. Although the formation is inclined very slightly to the east, this is perhaps largely an original depositional dip. There was, however, some post-Mesa and pre-Magdalena faulting, for at Honda the Mesa beds have been faulted down against the Upper Honda formation. It is on stratigraphic and structural grounds that the Mesa formation is referred to the Pliocene.

#### QUATERNARY

*Magdalena Formation.* Extensive deposits of stream gravels and boulders known as the Magdalena formation form the banks of the present drainage channels, the Magdalena river, and of streams tributary to it, and often extend for several miles on either side of the streams where they form terraces and boulder plains up to 200 feet and more above the stream beds. The constituent gravels and boulders are derived mainly from the Tertiary sandstones. They are embedded in a red sandy and silty matrix.

One of the most interesting facts regarding the Magdalena deposits is the widespread occurrence of coarse material in the lower courses of the streams. The abundant occurrence of cobbles and boulders along these lower stream courses where currents are now sluggish led to the apparently correct suggestion by the government geologists that precipitation and run-off must have been very much greater in the past than at present.<sup>24</sup>

Several distinct terraces at different levels above present-day streams give evidence of periodic uplift during recent times.

#### GENERAL DEPOSITIONAL HISTORY

The foregoing indicates that the Tertiary Magdalena embayment above El Banco was a long relatively narrow bay flanked on the east and west by narrow peninsulas extending out from the mainland mass south of Bogota. That this inlet was periodically in communication with marine waters during the early Eocene is indicated by the occasional occurrence of

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<sup>24</sup> "Memoria Detallada de los Estudios del Río Magdalena", Julius Berger Konsortium, Ministerio de Obras Publicas, Bogotá, (1926).

marine fossils in the Umir interbedded with continental deposits. After Umir times, however, the complete absence of marine fossils together with the lithologic character of the sediments indicates the competence of sedimentation to keep pace with the down-warping of the basin, and thus exclude the marine waters, throughout the remainder of Tertiary times. It is striking that although the maximum amount of sinking of the basin amounted to over 22,000 feet which is the apparent maximum thickness of the known nonmarine Tertiaries, waters from the open sea were never able to invade the area.

The large and consistent increase in thickness of sediments eastward in the basin is clear evidence of deltaic deposition, the strata to the west representing the bottomset beds and those in the eastern foothills the foreset. The chief source of sediments was, therefore, from the east. The topset beds of the delta, with their subaerial and subaqueous representatives, have been removed by erosion in the eastern foothills and cannot be examined.

The very short distance between great thicknesses of typically developed foreset beds and their thinner bottomset equivalents indicates the poor distribution of sediments and is the result of weak wave action and of the absence of tidal currents. The basin, however, could not have been particularly deep as some coarse sands are reasonably well represented as far out as the La Cira field. A minor part of the beds herein included as foresets may actually have been subaqueous topset beds, for, as Barrell has shown, topset beds may even attain a greater volume than the foreset beds when subsidence and deposition are about balanced.<sup>25</sup>

No typically deltaic deposits built out from the central Cordillera are known. This may be due in minor degree to concealment by overlap as it has been shown that the oldest exposed Tertiaries west of the Magdalena river belong to the Miocene. It is no doubt primarily due to the lower elevation and the more resistant rocks of the central Cordillera and to the fact that the major part of the drainage in the central mountains was probably into the basin of the present Cauca valley.

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<sup>25</sup> Barrell, J., "Recognition of Ancient Delta Deposits", *Bull. Geol. Soc. Amer.*, Vol. 23 (1912), p. 399.

DESCRIPTION OF A NEW SCORPAENOID FISH (NEOMERINTHE  
HEMINGWAYI) FROM OFF NEW JERSEY

BY HENRY W. FOWLER.

This Academy received in February 1935, an interesting rose fish from deep water off southern New Jersey, sent by Mr. Otway H. Brown. This specimen was from the same locality as a lot of fishes sent early in 1934, from about 50 miles southeast of Five-fathom Bank Light Ship.

The specimen was in excellent fresh condition when received, so that I had opportunity to study it before its brilliant coloring faded. According to Mr. Brown only the usual run of common fishes were brought to Cape May by the offshore fishermen. These were chiefly: *Pseudopleuronectes americanus*, *Centropristis striatus*, *Stenotomus chrysops*, and a few large *Cynoscion regalis*. The rose fish belongs in the Scorpaenidae and represents a new genus and species, though not closely related to any of the known forms of the Atlantic. It is greatly similar, not only in general appearance but also in structure, to the Pacific or Hawaiian genus *Merinthe* Snyder.

NEOMERINTHE, new genus

Body elongately ellipsoid, compressed. Head very large, nearly half of fish without caudal, robust, little compressed. Snout convex, broad, much longer than orbit. Eye rather small, high, much less than orbit, slightly premedian in length of the head. Maxillary reaches half way below eye or orbit, broadly expanded behind. Mandible large, protruding a little in front. Teeth all villiform, in bands in jaws, on vomer and palatines, none on tongue. Interorbital low. Occiput broadly convex. Spines of head all well developed, low. Hind nostril horizontal slit, greatly longer than front nostril. Gill rakers rather large asperous tubercles, only about five developed on ceratohyal as slightly elongated. Scales all finely ctenoid, on head largest on posterior sides, on body largest on middle of sides and lower portion of caudal peduncle. On fins only bases of pectoral and caudal scaly. Cutaneous flaps few on head, none over eye or orbit. Dorsal preceded by a short, rigid spine opposite upper front end of gill opening and followed by main fin of 8 rather strong spines of which last four graduated down low. Soft dorsal much shorter than spinous fin, rounded. Anal with 3 strong spines, second spine longest. Caudal moderate, rounded. Pectoral small, not reaching anal, of 17 rays of which seven of upper divided. Ventral with spine and 5 well-branched rays.

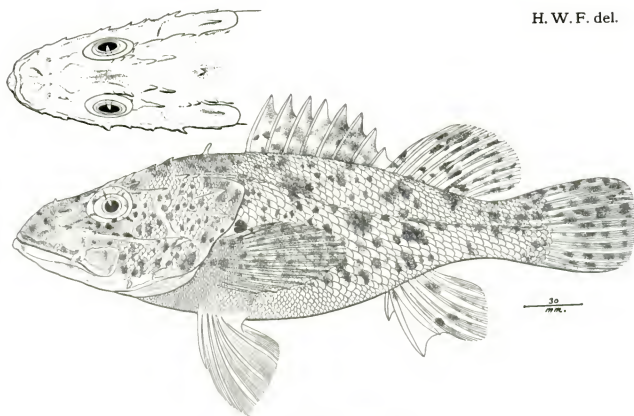
Type *Neomerinthe hemingwayi*, new species.

Falling in the Atlantic Scorpaeninae this genus is related to *Helicolenus* Goode and Bean and *Scorpaena* Linnaeus in branched upper pectoral rays,

and all three differing in this respect from *Pontinus* Poey, in which all the pectoral rays are simple. *Setarches* Johnson differs in having the lateral line in a broad, naked or scaleless groove, a single pair of occipital spines, and the bones of the head with large muciferous cavities.

*Neomerinthe* differs from *Merinthe* Snyder in the absence of supra-orbital tentacles, greatly shorter pectoral, upper pectoral rays divided and more or less finely scaled muzzle and maxillary. Though the first dorsal of *Merinthe* has 11 spines and that of *Neomerinthe* but 9, it is possible that in the anterior interval two more may have been present originally or in early youth.

(*Néos* new + *Merinthe*.)



H. W. F. del.

*Neomerinthe hemingwayi*

***Neomerinthe hemingwayi***, new species. Text-figure.

Depth 3; head  $2\frac{1}{2}$ , width 2. Snout to orbit  $3\frac{1}{2}$  in head from tip of snout; orbit 5,  $1\frac{2}{3}$  in snout; eye 7 in head from snout tip,  $2\frac{2}{3}$  in snout, equals bony interorbital; maxillary reaches  $\frac{2}{3}$  to hind eye edge, expansion equals eye, length  $2\frac{1}{2}$  in head from tip of snout; bands of teeth in jaws narrow, anteriorly 5 series transversely, irregular; bands of vomerine and palatine teeth narrow, on former greatly arched forward from middle; tongue small, rather broadly triangular; interorbital low, rather deeply concave; nasal pair of spines small; rather strong spine on upper front edge of orbit; row of 3 strong postero-supraorbital spines with lower one below third or last; small upper postocular spine followed by long low spine; 2 spines each side

of occiput, hind one larger; 2 spines before upper front end of gill opening; opercle with 2 large, flat, divergent spines; suborbital stay with ridge bearing 5 principal spines, last as large strong spine above preopercle angle, and each principal spine with small or accessory spine close and forward to its base; 2 spines, well spaced, over front part of maxillary, from pre-orbital; lower arch of preopercle with 3 rather low, short points. Gill rakers v, 1 + 5, vi,  $1\frac{1}{2}$  in gill filaments, which  $2\frac{1}{2}$  in eye.

Scales about 38 close along above lateral line to caudal base and 2 more on latter; tubes  $25 + 2$  in lateral line; 8 scales above lateral line to base of second dorsal spine, 13 below, 15 predorsal to occiput. Scales with 12 to 14 basal radiating striae; 63 to 70 small, more or less uniform apical denticles, with 3 or 4 series of basal elements; circuli fine.

D. I—VIII, I, 10, 1, second spine  $3\frac{1}{2}$  in total head length, first ray 3; A. III, 5, 1, second spine  $3\frac{1}{2}$ , first branched ray  $2\frac{2}{3}$ ; caudal 2, rounded behind; least depth of caudal peduncle  $4\frac{1}{3}$ ; pectoral  $1\frac{2}{3}$ ; ventral 2.

When fresh, bright orange vermilion to scarlet vermilion, paler to flesh color on under surfaces. Deepest tints of vermilion in or about crevices and grooves and about or along fin bases. Sides and above on both head and body with brilliant golden or gilt green to olive tints as very variable spots, blotches or mottling, some more or less neutral black. Iris vermilion like rest of general tint of body and fins. Inside mouth and gill openings bright vermilion. After being in alcohol the vermilion tints all fade to pink or rose and the lower surfaces of the body whitish. All the darker or gilt-like blotches become various shades of gray to slate or even black. Axil of pectoral with a few large dark gray blotches. When fresh ventrals uniform vermilion, all other fins with dark blotches.

A.N.S.P., No. 63482. About 70 miles southeast of Cape May, New Jersey. February 19, 1935. Otway H. Brown. Type.

Only the type known. The affiliations of this species are involved in its generic relationships which are discussed above.

(For Ernest Hemingway, author and angler of great game fishes, in appreciation of his assistance in my work on Gulf Stream fishes.)

# ORTHOPTERA OF THE UPPER RIO GRANDE VALLEY AND THE ADJACENT MOUNTAINS IN NORTHERN NEW MEXICO

BY MORGAN HEBARD.

From early July to early September 1934 the author had an uninterrupted opportunity to study the Orthoptera of the Rio Grande valley north of Santa Fé, New Mexico, the Sangre de Cristo Range bounding it on the east and the foothills of the Jemez Mountains to the west. The home station was the Rancho del Monte, two miles east of the indian pueblo of Tesuque. This ranch is at 7000 feet in the center of the zone of juniper and pinyon (Upper Austral Zone) where the latter, as is usual in all but the higher portions of this area, is almost wholly supplanted by the former tree. We were particularly pleased to be able to study the meagre but always intensely interesting orthopteran population of this zone, more thoroughly than has ever before been possible. The three most important finds were species peculiar to or at least almost always living in the junipers: *Melanoplus splendidus*, not known since the small original series was described; *Insara juniperi* a new species, and *Oecanthus californicus pictipennis* a new subspecies. Next in importance was the discovery so far north of *Heliastus benjamini* and *Hoplosphyrum boreale*, species hitherto supposed to be confined to near the southwestern border of the United States.

We have here discussed one hundred species, eighty-four taken in 1934, three additional from the same territory in 1917 found by Rehn and Hebard, five previously recorded from this region, and eight the known distribution of which shows that they are certain to be found there.

Of these seventy-six are found in the Upper Austral Zone, thirty-two in the Transition Zone, thirty-five in the Canadian Zone, thirteen in the Hudsonian Zone and three in the Arctic-Alpine Zone. Had the species known from the not distant but much lower (5026 feet) vicinity of Albuquerque been included, a large number of additions would have been made.

The species, divided into the families they represent, are found in the five life zones in the following numbers.

	Upper Austral	Transition	Canadian	Hudsonian	Arctic-Alpine
Blattidae .....	1	0	0	0	0
Mantidae .....	3	0	0	0	0
Phasmidae .....	3	2	1	0	0
Acrididae .....	47	24	27	12	3
Tettigoniidae .....	13	4	5	1	0
Gryllidae .....	9	2	2	0	0
	76	32	35	13	3
		(45)			

The letters after the names of the species indicate the Life Zones in which they are found, those in parentheses a Zone in which we know the species occurs but was not taken in this region. U is for the Upper Austral Zone, T the Transition Zone, C the Canadian Zone, H the Hudsonian Zone and A the Arctic-Alpine Zone.

Though elevation is by far the most significant feature in delimiting the Life Zones, the elevation of a certain area does not necessarily determine the Zone there present. Thus in apparently typical Transition Zone environment two miles north of Frioles Canyon at 8000 feet, a small area showed in the Orthoptera a strong Upper Austral influence. We have, therefore, not counted as present in the Transition Zone the following species, widely distributed through the Upper Austral Zone, which occurred there; *Mermiria texana*, *Opeia imperfecta*, *Psoloessa texana pusilla*, *Trimerotropis pallidipennis*, and *Trimerotropis cyaneipennis*. Zonal inversion is also frequently encountered, as in canyon bottoms often down to 7900 feet typical Canadian Zone may be present, whereas on hot dry outlying ridges typical Upper Austral Zone conditions may reach well above that elevation. Moreover the upper limits of the Zones, under otherwise similar conditions, reach decidedly higher on the southern than on the northern slopes of the mountains. The Arctic Alpine Zone is extremely restricted on Santa Fé Baldy (from 12300 to 12680 feet) and not a single species of Orthoptera is peculiar to it. We recognize it, however, as a distinct Zonal area, as the butterfly *Parnassius smintheus* D. and H. is definitely limited to it and the Dusky Marmot *Marmota flaviventris obscura* Howell on that mountain is similarly restricted, though it is again present in the cirques on Lake Peak (probably also Arctic Alpine areas) where it does not inhabit the precipitous upper slopes which are definitely Hudsonian to the summit at 12380 feet.

Other species which may well occur in the region here treated are: *Microcentrum rhombifolium* (Saussure) known as far north as Cedar Edge in southwestern Colorado. *Plagiostira albonotata* Scudder, recorded from Albuquerque and in northwestern New Mexico found by us at Farmington. See footnote 15.

Scudder and Cockerell's "A First List of the Orthoptera of New Mexico" includes not only an unusual number of synonyms but also many incorrect determinations and vague records. Of the latter the following might well lead one to expect to find the species in question in the regions now under consideration, though not one of these has as yet, and in many cases will never be, found there.

Recorded from "Northern New Mexico", material probably all from the eastern slopes of the Rocky Mountains or the plains of northeastern New Mexico.

*Eritettix tricarinatus* (Thomas) (as the synonym *navicula*)  
*Acrolophitus hirtipes* (Say)  
*Boopedon nubilum* Say (and as the synonym *flavofasciatum*)  
*Trachyrhachis aspera* Scudder  
*Trachyrhachis coronata* Scudder  
*Brachystola magna* (Girard)  
*Campylacantha olivacea vivax* (Scudder)  
*Dactylotum variegatum* (Scudder)  
*Udeopsylla robusta* Haldeman

Recorded from "Pecos River—Texas or New Mexico", material certainly not from the upper Pecos River if from New Mexico.

*Acrolophitus hirtipes* (Say)  
*Tropidolophus formosus* (Say)  
*Hesperotettix viridis pratensis* Scudder  
*Hesperotettix speciosus* (Scudder)  
*Melanoplus regalis* (Dodge)  
*Melanoplus* (probably) *bowditchi* Scudder (incorrectly recorded as the northwestern *cinereus*)

Gillette in 1904 recorded as *Melanoplus kennicotti* Scudder material from Chama, New Mexico, examination of which shows that *Melanoplus mexicanus mexicanus* (Saussure) was actually represented. We believe that the southern limit points for *Melanoplus kennicotti nubicola* (Scudder), the southern high mountain race of this boreal species, will not be extended much south of those already known in central Colorado.<sup>1</sup>

Although *Encoptolophus sordidus costalis* (Scudder),<sup>2</sup> *Xanthippus coralipes latifasciatus* Scudder, *Trachyrhachis kiowa kiowa* (Thomas), *Hadrotettix trifasciatus* (Say) and *Hesperotettix viridis nevadensis* Morse<sup>3</sup> have been found in the upper Rio Grande valley in Colorado, we believe that these species do not occur in the part of that river valley here under consideration. The first four are widely distributed over the Great Plains and would appear to have reached that area by crossing the Veta Pass, though it has an elevation of 9378 feet. The last is a race the distribution of which is almost entirely in the Great Basin and it apparently reaches its southeastern limit of distribution there at Alamosa.

The same is true for *Trimerotropis campestris* McNeill, which species, though we found it at Chama, New Mexico, locally frequent in grasses and plants on a boulder-strewn flat and along the banks of the Chama River at 7863 feet on September 10, 1921, is a boreal insect probably reaching very little south of that locality, in spite of the fact that to the west material before us proves that it occurs as far south as the White Mountains and Bill Williams Mountain in Arizona.

<sup>1</sup> See Hebard, Proc. Acad. Nat. Sci. Phila., LXXXI, p. 384, 1929.

<sup>2</sup> See Hebard, Ent. News, XLV, p. 104, (1934).

<sup>3</sup> Recorded as the synonym *gillettei* Bruner. See Hebard, Proc. Acad. Nat. Sci. Phila., LXXXI, p. 372, (1929) and *ibid.*, LXXXII, p. 393, (1931).



## BLATTIDAE

## POLYPHAGINAE

*Arenivaga erratica* Rehn. U.

Rancho del Monte, 7000 feet, August 10, 13 and 15 and September 14, 5 ♂ attracted to light at night. One simulated death when touched on an adobe wall upon which a light was shining, falling to the ground and there remaining motionless until picked up.

Considerable size variation is shown by the few specimens taken, the length (to the apices of the tegmina) ranging from 21.8 to 25 mm., the latter being for the largest specimen of the species we have seen.

This is a northeastern limital point of distribution known for the species, which has been recorded as far north as Durango, Colorado. Scudder and Cockerell's record of *Homoeogamia bolliana* from Las Cruces, New Mexico was probably based on a specimen of this species.<sup>4</sup>

## MANTIDAE

## AMELINAE

*Yersiniops solitarium* (Scudder). U.

Mesa north of Rio en Medio, 7100 feet, August 15, 1 ♂. Abandoned pueblo southwest of Rio en Medio on mesa, 7100 feet, August 29, 1 ♀ in parched short grass in open. Rancho del Monte, 7000 feet, July 20, 1 immature ♂ on roots of the Rocky Mountain Juniper (*Juniperus scopulorum* Sarg.) blending completely with its surroundings; August 15, 1 ♂ at light at night; August 25, same, high on adobe wall beside light not taken as when approached cautiously it gave sudden backward leap and escaped. Tsirigi (abandoned pueblo on mesa at eastern base of Jemez Mountains), August 30, 1 ♀ in short parched grass in open. Navawii (abandoned pueblo on mesa at eastern base of Jemez Mountains), August 25, (M. Hebard Jr.), 1 ♀.

The adults of this series are all very small for the species. Individuals are very alert, rapid in their movements, running as well as giving quick short leaps and hiding dexterously.

Northern limits in western Colorado are Animas and Durango.

*Litaneutria minor* (Scudder). U.

Abandoned pueblo southeast of Chupidero on mesa, 7100 feet, August 29, 1 ♀ in parched short grass in open. Rancho del Monte, 7000 feet, July 17, 1 large immature ♀ on trunk of juniper, its mottled gray coloration

<sup>4</sup> Saussure's record of *Homoeogamia bolliana* from New Mexico, as well as those by Saussure and Zehntner from "New Mexico and Texas" for *Ischnoptera bolliana*, *Ischnoptera uhleriana*, *Temnopteryx tezensis*, and *Chorisoneura tezensis* are, we are satisfied, based on incorrectly labelled material all of which, we believe, came from Texas.

blending remarkably with the bark; August 8, 1 ♂ (brachypterous) on porch floor under light at night; August 9, 1 ♂ (brachypterous) on adobe wall under light at night where numerous small insects had been attracted; August 15, 1 ♂ (brachypterous) at light; August 17, 1 ♀ (brachypterous) at light.

Though rarely seen this mantid is probably more common than the preceding species in this region.

#### MANTINAE

##### *Stagmomantis limbata* (Hahn). U.

Rancho del Monte, 7000 feet, August 13, 1 ♂ at light at night, flew away before net could reach it; August 13, 14 and 25 and September 1, 4 and 6, 10 ♂ all at light at night, one was found eating a moth, another was perched in the shadow behind the light shield alertly waiting for insects to approach; August 17, while examining many junipers at night with an electric torch in search of *Insara juniperi* here described, an adult and an immature female were found resting motionless but alert on the top clumps of foliage.

These specimens are all small for the species, the males largely green (except one in which the head and pronotum are dark brown, the dorsal fields of the tegmina suffused with the same and the cephalic limbs buffy annulate with light brown) and all have the tegmina without trace of spot or suffusion at the stigma, the marginal fields rich green bordered narrowly dorsad with whitish.

#### PHASMIDAE

##### PACHYMORPHINAE

##### *Parabacillus coloradus* (Scudder). U. (T.) (C.)

Mesa south of Chupidero, 7200 feet, July 18, in short grasses among juniper and pinyon, a half-grown specimen being dragged along by a rather small ant. It was still alive but the body had been completely severed just behind the median limbs. Rancho del Monte, 7000 feet, August 29, 1 ♀, attracted to light at night. Mesa two miles north of Frijoles Canyon, Sandoval County, 8000 feet, August 30, 1 small immature, taken by beating.

Had a series of this species been desired we believe such could have been secured by frequently beating rabbit-brush. By this means much the greater number of the large series in our collections have been captured by us in the past and had it not then been employed the insect would not have been found at many localities where it was taken.

##### HETERONEMIINAE

##### *Pseudosermyle straminea* (Scudder). U.

Rancho del Monte, 7000 feet, August 3, 8 and 23, 1 ♂ on each of these dates at light on adobe wall at night, seven feet from ground, at nine to

ten o'clock, and very alert, standing with body raised high; August 17 and 25, 1 ♀ on each date under very similar circumstances although on the latter the evening was unusually cool.

This species is often generally distributed through the "rabbit-brush", sometimes in large numbers, through the Southwest and a considerable series could probably have been secured by beating.

***Diapheromera velii velii*** (Walsh). U.

Three miles south of Santa Cruz, 5900 feet, August 15, 2 ♂, 1 ♀, all in a single low thick clump of rabbit-brush beside a very broad wash.

These males agree closely with typical *velii* but are large for the race, the female has the apices of the median and caudal femora very narrowly but distinctly blackish, the cerci moderately elongate. These specimens agree very closely with series now before us from Gran Quivera and far south from the White Sands of the Tularosa Valley in Otero County, New Mexico. These records constitute western known limits for the species.

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Our only material of *Diapheromera femorata* (Say) [T.] from New Mexico was taken in the mountains of the southern portion of the State, but as we have taken it as far northwest as Zion Canyon, Utah, we believe that, though Haldeman's recorded material did not come from Santa Fé proper, it probably did some from the adjacent mountains.

## ACRIDIDAE

### ACRYDIINAE

Though we did not find *Acrydium granulatum* Kirby [C.] [H.] in the Sangre de Cristo Range, it undoubtedly occurs there particularly in the Canadian Zone. Material is before us which was recorded as the synonym *incurvatum*; from the Rio Ruidoso in the White Mountains at 6500 feet by Scudder and Cockerell in 1902 and from Fort Wingate by Rehn and Hebard in 1909. These constitute southern limits in New Mexico.

***Acrydium acadicum acadicum*** (Scudder). C.

Tesuque Creek, Sangre de Cristo Range, 7900 feet, July 27 and 28, 1919, (J. A. G. Rehn; in lower border of Canadian Zone), 1 ♀, (pronotum abbreviate).

This boreal species has been found south as far as Cloudercroft in the Sacramento Mountains of New Mexico at 8800 feet.<sup>5</sup> It was probably this insect which Haldeman reported as *ornatum* from [the mountains in the vicinity of] Santa Fé.

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<sup>5</sup> Recorded as *crassum* (a synonym of *ornatum*) by Rehn and Hebard in 1909.

**Paratettix cucullatus extensus** Morse. U. (T.)

Otowi railroad station, 5825 feet, August 31, very small immatures (one kept) very numerous on edges of wet spots in adobe and gravel areas along the Rio Grande. The race undoubtedly occurs near constant water throughout this region except at high elevations. Scudder and Cockerell record it incorrectly as *Paratettix toltecus* from Santa Fé at 7000 feet and east of that locality at 7475 feet.

## ACRIDINAE

**Mermiria texana** Bruner. U.

Mesa two miles north of Frijoles Canyon, Sandoval County, 8000 feet, August 2, 1 small immature ♀, August 30, 1 ♂, 1 ♀, in tall yellow bunch grass growing in open area of pumice sand and gravel in Western Yellow Pine (*Pinus ponderosa*) forest.

This constitutes a point on the northwestern boundary of the species which is known north as far as Salida and Manitou, Colorado.

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The fact that *Eritettix variabilis* Bruner [T.] appears adult early in the season and has usually become very scarce by early July probably explains our not finding it in the mountainous portions of the region here being studied. It will surely be found there as we have material before us from Jemez Hot Springs, New Mexico, and have recorded it from Gray Creek in Las Animas County, Colorado, at 6800 to 7000 feet. These are northern limit points and the latter an eastern limit as well.

**Opeia imperfecta** Bruner. U.

Mesa two miles north of Frijoles Canyon, Sandoval County, 8000 feet, August 30, 1 ♂, 1 ♀, 1 very small immature ♀, in tall yellow bunch grass growing in open area of pumice sand and gravel in Western Yellow Pine forest. These were the only specimens of this species seen this summer. The record constitutes a northern limit point.

**Cordillacris occipitalis occipitalis** (Thomas). U.

Taos, 7000 feet, August 16, 1 ♂ near short dry grasses in open area with much Tumble Weed and a few green plants (upper portion of juniper and pinyon zone). Rancho del Monte, 6950 feet, July 12, 1 ♀, only one seen in areas of short parched grass on flat.

The male is typical of the usual southwestern condition with caudal tibiae buffy, but the female has the caudal tibiae weakly tinged with pink.

**Cordillacris crenulata** (Bruner). U.

Mesa north of Rio en Medio, 7100 feet, August 15, 1 ♀ taken, few in short parched grass among junipers. Cuyamungue, 6300 feet, July, 12, very scarce in areas of parched short grass. Tsankowi (abandoned pueblo on mesa at eastern base of Jemez Mountains), July 20, 3 ♀, occasional in

parched short grass in open. Cerrillos Mine, 6000 feet, August 4, 1 ♂, 1 ♀, 1 large juv. ♂, generally distributed in small numbers but the most abundant species of Orthoptera present on rolling plains of short parched grass with scattered junipers.

These are northwestern limital points but to the east and north in Colorado the species is known west as far as Canyon City and Fort Collins.

**Orphulella pelidna** (Burmeister). U.

Otowi railroad station, 5825 feet, August 31 1 ♂ (blackish brown) in green marsh grass. This was the only specimen seen but the species probably occurs frequently in marshy areas along the Rio Grande.

**Neopodismopsis abdominalis** (Thomas). C. H.

Foot of saddle, Nambe Divide, Sangre de Cristo Range, 10700 feet, August 1, very scarce, 1 ♀ and a few immatures in lush Hudsonian Zone herbage; August 12, 1 ♂, 3 ♀, 1 juv. ♂, 1 juv. ♀; August 18, 3 ♂, 3 ♀ (in small numbers locally). We also found this insect present but decidedly rare down to 9500 feet in the undergrowth of the Canadian Zone forest of the upper canyon of the Rio en Medio. Aspen Ranch, Rio en Medio, Sangre de Cristo Range, 9000 feet, July 26, 1 juv. ♀ only, in lush mountain grasses of Canadian Zone near stream.

Considerable size variation is shown, but the series averages extremely depauperate for the species.

These localities are very close to the altitudinal limits for the species in this latitude. It has been recorded, but referred to *Chlocaltis*, from Truchas Peak (Rehn), as far east as Beulah in the Las Cegas Range (Scudder and Cockerell) and south to Clouderoft in the Sacramento Mountains (Rehn and Hebard) in New Mexico. We have also taken it southward on the summit of the Sandia Mountains at 10000 feet.

**Chorthippus curtippennis** (Harris). C. H.

Present in lush mountain herbage of the Sangre de Cristo Range from 11000 feet (Nambe Saddle, August 21, 1 ♂ in green herbage under spruces) in the Hudsonian Zone, down to 9000 feet (Aspen Ranch, few seen July 26 and later) in the Canadian Zone; but more abundant locally in the lush Hudsonian Zone herbage at the foot of Nambe Saddle, 10700 feet, August 12 and 18, 1 ♂, 2 ♀ taken.

Eastern and southern limits of distribution are the same as given for the preceding species.

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As *Gomphocerus clavatus* Thomas [probably A] has been recorded in New Mexico from above timber line on Truchas Peak (as the synonym *clepsydra* by Scudder and Cockerell in 1902 and Rehn in 1904, this corrected by Rehn and Hebard in 1909) and also from Clouderoft in the Sacramento

Mountains, the species almost certainly occurs in the southern section of the Sangre de Cristo range though we did not find it there.

***Ageneotettix deorum deorum*** (Scudder). U.

Cerrillos Mine, 6000 feet, August 4, 1 ♂, only specimen found on plains of short dry grass. The species was not seen anywhere north of Santa Fé during the summer.

***Psoloessa texana pusilla*** (Scudder). U.

Rancho del Monte, 7000 feet, July 19, 2 ♂, 2 ♀, occasional in short parched grass among junipers and pinyon up to mesa top to the northeast at 7100 feet. Mesa two miles north of Frijoles Canyon, Sandoval County, 8000 feet, August 2, 1 ♀, the only specimen seen in the scant grasses under Western Yellow Pines growing on volcanic sand and gravel.

***Psoloessa delicatula delicatula*** (Scudder). U. T. C.

Ridge between Chupidero and Rio en Medio Canyons, Sangre de Cristo Range, 9100 feet, July 19, 1 ♂ only seen and taken in short dry grass and mountain flowers on rounded open summit. Otowi railroad station, 5825 feet, August 31, 1 small juv. ♀ in short grasses near the Rio Grande. Tsankowi, July 20, 2 ♀ taken, very scarce in open areas of short grass. Cerrillos Mine, 6000 feet, August 4, 2 ♂ with *Cordillacris crenulata*; with that species generally distributed in the areas of short parched grass in this area, but much scarcer.

This insect is probably present earlier in the season in considerably greater numbers throughout this region up to the upper limits of the Canadian Zone.

***Aulocara elliotti*** (Thomas). U. T. C.

Ridge between Chupidero and Rio en Medio Canyons, Sangre de Cristo Range, 9100 feet, July 19, 1 ♀ taken, very few seen on open rounded summit in short dry grass and mountain flowers. Chupidero Canyon, Sangre de Cristo Range, 8450 feet, July 23, 1 ♀ seen and taken in short green grass of opening in Canadian Zone conifer forest. Cuyamungue, 6300 feet, July 12, 2 ♀ on adobe flat covered with short parched grasses and small clumps of rabbit-weed. Thankowi, July 20, one only seen in large open spaces with short parched grass among juniper and pinyon.

Present in grassy areas throughout this region up to 9100 feet, the species this season was decidedly scarce, but may be expected to sometimes appear in large numbers.

#### OEDIPODINAE

***Arphia conspersa*** Scudder. T. C.

1875. *Arphia conspersa* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 514. [♂, ♀; Dallas, Texas.]

1876. *Arphia teporata* Scudder, Ann. Rept. Chief Eng., p. 508. [Single type selected by Hebard in 1929; ♂, southern Colorado.<sup>6</sup>]

Study of the types of *conspersa* and *teporata* and comparison with enormous series of the species now available shows the latter to be a synonym. Like the synonyms *arcta* and *frigida*, *teporata* was based on the boreal condition, which we do not feel can be separated from *conspersa* though typically appearing quite different. Caudell placed *teporata* as a synonym of *arcta* in 1903.

Ridge between Rio en Medio and Chupidero Canyons, Sangre de Cristo Range, 9100 feet, July 19, 1 ♂ (with wing disk light yellow) only, in short dry grass and some mountain flowers on rounded open summit. Chupidero Canyon, Sangre de Cristo Range, 8100 feet, July 25, 1 ♀ (with wing disk light yellow), very scarce in opening of short green grass in Western Yellow Pines. Mesa two miles north of Frijoles Canyon, Sandoval County, 8000 feet, August 30, 1 very small immature ♂.

This species is probably present in moderate numbers earlier in the season throughout the Canadian Zone in this region. It has previously been recorded as *teporata* south to Highrolls and Cloudercroft in the Sacramento Mountains of New Mexico.

**Chortophaga viridifasciata** (DeGeer). U. (T.)

Otowi railroad station, 5825 feet, August 31, a very few, pale green, extremely small individuals (one male and one female kept) on edges of wet spots on adobe and gravel along the Rio Grande.

This species may have been fairly numerous, particularly in irrigated areas, earlier in the season.

**Camnula pellucida** (Scudder). C. H.

This species was common locally in the short but dry green grasses almost everywhere we went in the Sangre de Cristo Range from 8540 feet (one male kept from 9100 feet) to the upper limits of the Canadian Zone and present also in the open in the grasses and plants of the Hudsonian Zone up to 10700 feet (pair kept) from July 12 to August 18. Early in September its numbers were greatly reduced by hail storms and cold, as was the case with all of the other mountain species.

Beulah, the ridge between Rio en Medio and Chupidero Canyons and Valencia County are southern limits of distribution.

**Xanthippus corallipes leprosus** Saussure. C.

Ridge between Rio en Medio and Chupidero Canyons, Sangre de Cristo Range, 9100 feet, July 22, 1 ♀ in short dry grass and mountain flowers on rounded open summit and before capture not distinguished from the large numbers of *Cratypedes neglectus* there present.

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<sup>6</sup> Material from northern New Mexico was also described.

This specimen is one of the last survivors of a species which, like *Arphia conspersa*, appears adult in the spring and is probably then frequently to be found in open spaces of the lower portions of the Canadian Zone in the Sangre de Cristo Range.

This specimen agrees closely with topotypes (taken with the type) near Taos, New Mexico, from which locality Scudder and Cockerell incorrectly reported material as *paradoxus* and as *pumilus*. A slightly atypical female from Pecos was recorded as *Hippiscus zapotecus* by Rehn in 1904.

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Although we did not find *Xanthippus corallipes altivolus* Scudder anywhere in the Sangre de Cristo Range, it should occur there from the upper portions of the Canadian Zone well up into the Hudsonian Zone, as it is known from many records at high elevations in the mountains of Colorado and Arizona.

New Mexican material of this race is before us from the White Mountains at 9700 feet and from Cloudcroft in the Sacramento Mountains at 8600 to 8700 feet recorded as the synonym *pumilus* by Rehn in 1902. Specimens from Jemez Hot Springs before us and a series from Fort Wingate recorded as *cupidus* (males) and *affrictus* (female) by Rehn and Hebard in 1909 are nearer *c. leprosus* though showing a strong tendency toward *c. altivolus*.

This insect is separated from *X. c. leprosus* Saussure mainly by its smaller size, more robust form and less caudate organs of flight which in the female are often so reduced that sustained flight would be impossible.

**Cratypedes neglectus** (Thomas). T. C.

Abundant from the summits of the ridges between the Rio en Medio and Chupidero Canyons up to 9100 feet, down to 8450 feet in Chupidero Canyon in the Sangre de Cristo Range from July 19 to 23, 2♂, 4♀. The insect was found in fairly frequent small colonies both in the dry short grasses of the open areas and in the dry mountain plants of the Aspen (*Populus tremuloides*) forests and below in the green grassy openings in the conifer forests. Next to *Camnula pellucida* it was the most abundant species of the Canadian Zone.

**Leprus cyaneus** Cockerell. U.

Rancho del Monte, 7050 to 7250 feet on ridges and mesa in Juniper and Pinyon Zone, found singly and not at all frequently. July 17 to August 10, 3♂, 1♀, 1 juv. ♀ and 1♂ July 20 attracted to light at night. Others were seen when not collecting, the species appearing adult here in largest numbers about the third week of July.

**Dissosteira carolina** (Linnaeus). U. T.

Generally moderately common (1♂ kept) about irrigated areas along the Rio Tesuque at 6700 to 6800 feet July 17 and a few on bare ground at



Rancho del Monte up to summits of ridges at 7200 feet July 17. This insect was also seen as high as 8000 feet at the mouth of Chupidero Canyon on August 3, its range evidently covering all of the Juniper and Pinyon Zone in this region.

Southern limits in New Mexico are the White Mountains and Gallup.

**Spharagemon inornatum** Morse. U. (T).

Although diligent search was made for this insect in the thickets of scrub oak in the canyons and lower slopes of the Sangre de Cristo, only a single large male was seen and taken above Rio en Medio in the small canyon choked with oaks, clematis and other green herbage at 7200 feet on August 14.

This specimen measures; length of body 24.7, length of pronotum 5.7, length of tegmen 40, length of caudal femur 14.4 mm.

The species in New Mexico has been recorded from Santa Fé, as far east as Gallinas Canyon and Hot Springs in the Las Vegas Range, and material which we collected in the Sandia Mountains from near Tijeras at 7000 feet to above Well Country Camp at 9000 feet is from as far south as the insect has been found.

**Derotmema haydenii haydenii** (Thomas). U.

Taos, 7000 feet, August 16, 2♂, 3♀, very numerous on adobe mainly overgrown with tumble weed in open in Juniper and Pinyon Zone, only two with wing disk pink seen among very large number with that area yellow. Rinconada, Rio Arriba County, 5987 feet, August 16, 1♀, wing disk yellow. Pojoaque, 6150 feet, July 12, 2♀ wing disk yellow, small and very widely scattered colonies on bare adobe areas of flats with much parched short yellow grass; July 13, 2♂, 1♀ wing disk yellow, very few on slightly roughened adobe between Greasewood Bushes (*Sarcobatus vermiculatus*).

This race has also been recorded from "northern New Mexico" as the synonym *cupidineum*.

It is interesting to note how definitely this species is confined to bare adobe, usually where the latter is perfectly smooth and flat.

#### REHNITA<sup>†</sup> new genus

Genotype;—*Rehnita gracilipes* (Caudell).

Nearest relationship is to *Trachyrhachis* Scudder, the species of closest affinity in that genus being *kiowa* (Thomas). From it *Rehnita* particularly differs in the lack of cristation of the median carina of the pronotal meso-

<sup>†</sup> Our co-worker Mr. James A. G. Rehn has long recognized that *Psinidia capito* Stål, described from Texas in 1873 and since then referred to *Mestobregma*, and *Mestobregma gracilipes* Caudell described from Nogales and the Huachuca Mountains, Arizona, in 1905, were not properly referable to the genus *Mestobregma*. We here propose a new genus, naming it in his honor, in recognition of the excellent work he has accomplished in the North American Oedipodinae.

zona, the evenly subsiding dorsal flange of the caudal femur,<sup>8</sup> the more graceful form, more attenuate limbs and smoother surfaces.

Size medium small. Form decidedly graceful. Head elongate vertical, narrowing dorsad, with eyes prominent and elevated well above the pronotum. Face nearly vertical and rounding into vertex. Antennae very slender and much longer than combined length of head and pronotum. Pronotal medio-longitudinal carina weak, not or very feebly cristate in prozonal portion, first sulcus prominent on disk and all sulci prominent on lateral lobes and cutting medio-longitudinal carina, which shows no crista-tion whatever between them. Pronotal lateral lobes (as in *Trachyrhachis kiowa*) higher than wide, with ventro-caudal angle moderately produced, subrectangulate, acute or sharply rounded, the ventral margin oblique and ascendant cephalad. Caudal margin of pronotal disk rectangulate produced and angle very sharply rounded. Interspace between mesosternal lobes transverse. Wing disk yellow, band broad, taenia short.

**Rehnita capito** (Stål). U.

Rinconada, Rio Arriba County, 5987 feet, August 16, 1 ♂, 1 ♀ only of this species of the southern Great Plains were seen and taken in areas of scant parched grass. This is a western limit for the species, known in Colorado northwest as far as Canyon City.

**Trachyrhachis kiowa fuscifrons** (Stål). U. (T.) C.

Taos, 7000 feet, August 16, 1 ♂, 1 ♀, only specimens seen and taken on adobe heavily overgrown with tumble weed in open area in Juniper and Pinyon Zone. Ridge between Rio en Medio and Chupidero Canyons, Sangre de Cristo Range, 9100 feet, July 19, 1 ♂ alone seen and taken among short dry grasses and mountain flowers on rounded open summit. Cerrillos Mine, 6000 feet, August 4, 2 ♂, 1 ♀, 1 large Juv. ♀, locally in small numbers in short dry grass among scattered junipers.

Though evidently very widely distributed through the Juniper and Pinyon Zone and far up into the Canadian Zone, this insect was very rarely seen.

**Mestobregma plattei corrugata** (Scudder). U.

Pecos, 6400 feet, August 11, 1 ♀, on gradual brush-covered slope. Chamita, Rio Arriba County, 5925 feet, September 3, 2 ♂, 1 ♀ in sandy gravelly area among rabbit weed near broad wash. Three miles south of Santa Cruz, 5900 feet, August 15, on adobe and pebbles at foot of low hills along wash, 1 ♂. Pojoaque, 6150 feet, August 13, 3 ♂, 1 ♀, few on slightly roughened adobe among *Sarcobatus* bushes. Mesa north of Rio en Medio, 7100 feet, August 15, 1 ♀ among junipers. Rancho del Monte, July 12 to August 10, 6950 to 7100 feet, 2 ♂, 5 ♀ the most abundant but still not numerous species found among the juniper and pinyon from the flats and

<sup>8</sup> This feature is variable in *T. coronata* Scudder, where the subsidence of the dorsal flange of the caudal femur varies individually from sudden to gradual.

low ridges up to the level surfaces of the mesa. Tsankowi, July 20, 1 ♀ in open areas of short grass. Cerrillos Mine, 6000 feet, August 4, 1 ♂ only seen and taken in parched short grass among junipers.

The wing disk was yellow in every specimen we saw of this frequently encountered species.

**Conozoa sulcifrons acuminata** Scudder. U.

Otowi railroad station, 5825 feet, August 31, 4 ♂, 1 ♀, one small colony found on sand and gravel wash near the Rio Grande. This insect is much less frequently encountered in this region than we had supposed would be the case.

**Trimerotropis texana** (Bruner). U.

Rinconada, Rio Arriba County, 5987 feet, August 16, 2 ♂, 3 ♀, very local, a few small colonies on washes among sage brush and joint cactus. Chamita, Rio Arriba County, 5925 feet, September 3, 1 ♂ on bare ground among rabbit weed near wash. Three miles south of Santa Cruz, 5900 feet, August 15, 1 ♂, 2 ♀, very scarce on bare adobe and pebbles among rabbit weed at foot of low hills along wash. Rancho del Monte, 6950 feet, July 12, 1 ♀, on bare adobe near wash among rabbit weed. Otowi railroad station, 5825 feet, August 21, 1 ♂, 1 ♀, only specimens seen on gravelly adobe among rabbit brush and a few small junipers.

Rinconada, Chamita, Santa Cruz and Otowi station constitute western limit points in the known distribution of this species.

**Trimerotropis gracilis gracilis** (Thomas). U.

This species was found present on adobe at the two localities examined where we encountered Sage Brush (*Artemisia tridentata*) in this region. At Rinconada, Rio Arriba County, 5987 feet, August 16, only a single male was seen and taken, but at Tsirigi, August 30, it was moderately common (1 ♂, 2 ♀ taken).

These are southeastern points on the known limits of distribution of the species.

**Trimerotropis pallidipennis pallidipennis** (Burmeister). U.

Typical males were seen at Taos, 7000 feet, August 16 (one taken), at Rinconada, Rio Arriba County, 5987 feet, August 16 (one seen) and one at the Rancho del Monte, 7000 feet, July 12. A very pale immature female was also taken at Rinconada and pale adults were found in areas of light-colored volcanic sand dotted with clumps of tall yellow grass; a pair (very pale) at the foot of the Tsankowi Mesa, July 20; 2 ♂ two miles north of Frijoles Canyon, on mesa at 8000 feet, August 2 and 30.

**Trimerotropis agrestis** McNeill. U.

This species was found locally numerous on very sandy abode among scattered sand-loving plants along the broad sides of wide washes at

Chamita, 5925 feet, on September 1 and 3, (7 ♂, 5 ♀), and three miles south of Santa Cruz, 5900 feet, on August 15, (11 ♂, 11 ♀).

It is peculiar to a sand environment and probably occurs in such situations throughout this portion of the Rio Grande valley.

**Trimerotropis pistrinaria** Saussure. U.

Rio en Medio, 7000 feet, August 15, 2 ♂, 2 ♀, few on bare pebbly areas among junipers on upper slopes of ridges. Rancho del Monte, 7020 to 7100 feet, August 10, 2 ♂, 1 ♀, usually found singly and widely separated on the almost bare gravelly crests of the ridges among junipers, present throughout our stay.

Next to *Mestobregma plattei corrugata* this is the most frequently seen grasshopper in this parched environment where few specimens could be secured during the day but where intensive work at night, continued for weeks, resulted in the capture of many valuable katydids and crickets. The species was never present in the adjacent valleys or on the flats.

The insect of this region is marked much as is normal in Great Plains material (upon which the synonymized *bruneri* was based) but is definitely more slender with longer organs of flight. Typical *pistrinaria* from the white outcrops near Dallas, Texas, averages even heavier than that condition, with organs of flight as much reduced and showing very narrow tegminal bands, while series from the mountainous sections of western Texas, southern New Mexico and southeastern Arizona average much larger, as robust, with longer organs of flight showing usually very prominent tegminal bands. The variation shown in some of the series suggests that we have merely to deal with a very plastic species, but we can not state that geographic races do not exist until all of the material and data has been thoroughly analyzed.

**Trimerotropis laticincta** Saussure. U.

This species was found in small numbers (3 ♂, 2 ♀ taken) on slightly roughened adobe between *Sarcobatus* bushes on a flat at Pojoaque, 6150 feet, August 13. It probably occurs along the Rio Grande in similar environment throughout this region. This is a northwestern limit point, if the very closely related insect of the Great Basin is distinct, the present Great Plains condition occurring in Colorado as far west as Canyon City.

The present material agrees closely with Great Plains series, averaging no longer than is usual in series from the northern portion of eastern Colorado.

**Trimerotropis tolteca modesta** Bruner. T.

Found only on volcanic sand and gravel under Western Yellow Pines at 8000 feet on a mesa two miles north of Frijoles Canyon, Sandoval County, on August 2 and 30, (14 ♂, 6 ♀). It was the most abundant grasshopper

there present, occurring in fairly frequent small colonies. Individuals crackle when alighting, the males doing this more strongly than the females.

This is an eastern limital point in the known range of the species. We incorrectly recorded material of this race as "*Spharagemon*" *humile* from Pinkerton Hot Springs and Carbon Junction, Colorado. These are also eastern limits and the former is a northern limit as well.

**Trimerotropis cincta** (Thomas). T. C.

Ridge between Rio en Medio and Chupidero Canyons, Sangre de Cristo Range, 9100 feet, July 19, 1 ♂, 2 ♀ summit in dry mountain undergrowth of Aspen forest. Chupidero Canyon, Sangre de Cristo Range, 8450 feet, 1 ♂ under Western Yellow Pines. Mesa two miles north of Frijoles Canyon, Sandoval County, 8000 feet, August 2 and 30, 2 ♂ on volcanic sand and gravel in scanty grasses under Western Yellow Pines.

In this region this is apparently a rather scarce species. Males fly with a distinct whirr.

The material certainly represented this species which Scudder and Cockerell recorded from [the mountains near] Santa Fé as *juliana* and from Las Vegas Hot Springs as *caeruleipes*.

**Trimerotropis cyaneipennis** Bruner. U.

Rio en Medio, 7000 feet, August 15, 2 ♀, very few on bare gravel and adobe slopes among junipers near wash. Mesa south of Rio en Medio, 7100 feet, August 29, 1 ♂ on flat surface with short parched grasses and numerous junipers. Rancho del Monte, 7000 to 7100 feet, August 12, 13 and 23, 1 ♂, 2 ♀ on gravelly soil among junipers near wash, one at light at night. Canyon south of Tsirigi, August 30, 1 ♂, under Western Yellow Pines. Mesa two miles north of Frijoles Canyon, Sandoval County, 8000 feet, August 2 and 30, 6 ♂, 4 ♀, occasional on volcanic sand and gravel with scanty undergrowth under Western Yellow Pines.

The wing disk in this entire series is a green yellow, very different from the blue green or (in some regions) purple shown by the species over the greater portion of its range. Whether remarkable chromatomorphs peculiar to certain geographic areas or races are represented remains to be determined. Certain it is that the difference noted above is constant and not subject to variation over the area here studied.

This is apparently a rather scarce insect in this region, occurring from the lower edge of the Transition Zone down to the middle of the Juniper and Pinyon Zone. Individuals make a sharp crackling when flying, much like that of *Trimerotropis suffusus*.

**Trimerotropis sparsa** (Thomas). U.

Three miles south of Santa Cruz, 5900 feet, August 15, 1 ♂ in same environment as below. Pojoaque, 6150 feet, August 13, 17 ♂, 6 ♀, a large colony present on the very smooth bare adobe floor of a small arroyo which there traversed a *Sarcobatus* flat.

The males fly up with a decided whirr, the females sometimes giving a weaker and shorter whirr usually just before alighting.

These are western limital points, the latter being a southern limit as well.<sup>9</sup>

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We find that *Trimerotropis suffusa* Seudder [T.] was reeorded by Caudell but referred to *Circotettix* from Chama, New Mexico in 1903 and we found it fairly abundant there. Its established synonyms *obscura* and *nubila* were described from northern New Mexico and Hot Springs in the Las Vegas Range respectively. These are southern known limits, but it should occur as far south in the areas of Western Yellow Pine in the Sangre de Cristo Range. The species does not occur at Albuquerque, whence Rehn recorded it in 1904.

***Circotettix rabula altior*** Rehn. Atypical T. C. H.

Saddle at Nambe Divide, Sangre de Cristo Range, 10800 feet, August 12, few seen; on trail down to foot of saddle, 10700 feet, August 18, 1 ♀, few locally on trail, this area Hudsonian Zone. Ridge between Rio en Medio and Chupidero Canyons, Sangre de Cristo Range, 9100 feet, July 19, 1 ♂, 2 ♀, small colonies in open on summit and in openings of Aspen forest. Chupidero Canyon, Sangre de Cristo Range, 8400 feet, August 14, 3 ♂, 1 ♀ (slightly atypical), in moderate numbers in bare spots on road among Western Yellow Pines of Canadian Zone. Mesa two miles north of Frijoles Canyon, Sandoval County, 8000 feet, August 30, 1 ♀ (atypical), very few in rocky spot among Western Yellow Pines.

This species occurs in this region from near the lower margin of the Transition Zone up through the lower portion of the Hudsonian Zone, being numerous only locally in the upper portion of the Canadian Zone.

All previous records of *Circotettix undulatus* from this region are referable to this race, those reeorded by Rehn from Albuquerque coming from the adjacent Sandia Mountains.

***Heliasius parviceps*** (F. Walker). U.

Rinconada, Rio Arriba County, 5987 feet, August 16, 1 ♀, only specimen seen, in sandy arroyo. Ranch del Monte, 6950 feet, July 12, 1 ♀, only specimen seen, in gravelly wash. Otowi railroad station, 5750 feet, August 31, very small immatures found (three kept) on edges of wet spots on gravel near the Rio Grande.

This species appears adult in greatest numbers in the spring, and over the greater portion of the Southwest has become scarce as early as the first of July.

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<sup>9</sup> Our mistake, stating in 1928 that the type of this species had been erroneously labelled "New Mexico", was corrected by us the following year.

Rinconada is a northeastern and Rancho del Monte an eastern limit for *parviceps*.

***Heliastus benjamini*** Caudell. U.

Chimayo, 7000 feet, August 8, 4 ♂, 5 ♀, present in small numbers on bare gravel and pebbles near stream below the Santa Cruz dam and on bare silt among peppers in an irrigated patch.

This is a very considerable extension northeastward of the known range of this beautiful species.

#### BATRACHOTETRIGINAE

As *Phrynotettix tschivavensis* Haldeman U. has a synonym *taosanus* Rehn (indicated by Hebard in 1932) which name was based on material taken in the Taos Valley in June, 1883 (of which there is a female topotype taken with the type, in the author's collection), the species should be sought throughout the Upper Austral Zone in the region here under consideration. We believe that in this region it is scarce and local. Another northern limit in New Mexico is Fort Wingate, where an immature male was taken July 24, 1910, by John Woodgate.

#### CYRTACANTHACRINAE

***Eremiacris pallida*** (Bruner). U.

Three miles south of Santa Cruz, 5900 feet, August 15, two females seen, one taken, in tufts of short dry grasses at foot of low hills near wash, where *Trimerotropis texana* was present.

This is a northeastern limit point in the known distribution of the species.

We did not find *Eremiacris virgata* (Scudder) U. in this region, though western limits, where we have taken that species, are Farmington at 5300 feet and Albuquerque, New Mexico, at 4800 to 4900 feet. It should also be found in the upper Rio Grande valley, as in eastern Colorado its distribution is known to extend north to Roggen.

***Schistocerca shoshone*** (Thomas). U.

Chimayo, 7000 feet, August 8, 1 ♂, occasional in willows along irrigating ditch. Pojoaqui, 6150 feet, August 15, 1 ♀ in green weeds beside road near irrigated areas. Otowi railroad station, 5825 feet, August 31, pair in willows near Rio Grande.

These are all uniformly green individuals. Present only in and about irrigated areas or near water in the lower portion of the Zone of Juniper and Pinyon.

***Aeoloplus turnbulli turnbulli*** (Thomas). U.

1872. *C[aloptenus] turnbulli* Thomas, Ann. Rept. U. S. Geol. Surv. Terr., V, p. 452. [♂, ♀; between Red Buttes and Independence Rock [on the Sweetwater River], Wyoming.]

1876. *Pezotettix plagosus* Scudder, Ann. Rept. Chief Engineers, 1876, p. 504. [♂, ♀; northern New Mexico.]

In 1925 we recognized the fact that instead of two species, a northern (and mountain) and a southern plains race of *turnbulli* existed. Unfortunately we assumed that the oldest name for the latter was *plagosus*, but study of the type shows beyond question that it is from the mountains, not the plains, of "northern New Mexico" and is a synonym of *turnbulli turnbulli*.

As a result the race from the southern plains, which we have regularly recorded for the last ten years as *turnbulli plagosus*, must be recognized as *turnbulli bruneri* Caudell.

Tsankowi, Sandoval County, July 20, 1♂, 2♀ in a gray-green leaved shrub in open on flat summit of mesa.

These specimens are very small but about as robust as is usual in this race. A larger and more robust female, showing fully as great reduction in the organs of flight, was taken at Tijeras in the Sandia Mountains at 7000 feet on July 29, 1919 by the author where occasional individuals were seen in the sage brush. This constitutes a southern limit record for the race.

***Hesperotettix viridis viridis*** (Thomas). U.

Summit of Santa Fé Baldy, Sangre de Cristo Range, 12550 feet, July 20, 1♀, above timber line, active in Arctic Alpine herbage. This specimen, which has the full development of the organs of flight as found in this race, we can only believe had been caught and carried upward in the terrific updraft from the Rio Grande Valley far below. Mesa north of Rancho del Monte, 7200 feet, July 19, 1♂, 1♀, very few in small clumps of rabbit weed among juniper and pinyon. Rancho del Monte, 7000 feet, July 20, 1♀, at light at night; very few seen in rabbit weed on August 2. Three miles south of Santa Cruz, 5987 feet, August 15, 3♂, very few in rabbit weed along wash. Pojoaque, 6150 feet, August 13, 1♂ only, in rabbit weed in wash. Cuyamungue, 6300 feet, July 12, 1♀, exceedingly numerous in tufts of a very small composite (rabbit weed) growing closely on an adobe flat. Cerrillos Mine, 6000 feet, August 4, 1♂, very few in rabbit weed.

This species is the most abundant and generally distributed grasshopper of the lower portions of the Juniper and Pinyon Zone, though it probably lives there entirely in composites (rabbit weed), extending its continuous distribution no higher than the upper portions of this zone. Our above record from the Arctic Alpine Zone can not be considered anything but a most unusual accidental occurrence there.

***Melanoplus aridus*** (Scudder). U. T. C.

Ridge between Rio en Medio and Chupidero Canyons, Sangre de Cristo Range, 9100 feet, July 19, 2♂, 1♀, moderately common in dry mountain herbage in Aspen forest of Canadian Zone. Chupidero Canyon, Sangre de



Cristo Range, 8000 feet, July 25, 1 ♂ (large for this region), 1 ♀ (moderately large for this region), few in forest undergrowth, particularly among oaks. Chimayo, 7000 feet, August 8, 1 ♂, 3 ♀, large and richly colored individuals in irrigated field, smaller and grayer specimens were seen in large gray-green leaved composites. Rancho del Monte, 7000 feet, July 17, 1 ♂ seen but escaped in a juniper (the insect is extremely active and jumps most vigorously); all the following at light at night July 31, 1 ♂, August 13, 2 ♀, August 30, 1 ♀, August 31, 1 ♂, September 1, 1 ♂, 1 ♀, September 2, 2 ♂, 1 ♀, September 3, 2 ♂, 1 ♀, September 4, 1 ♂. Mesa two miles north of Frijoles Canyon, Sandoval County, 8000 feet, August 30, 1 ♂, 1 ♀, few in plants on volcanic sand under Western Yellow Pines in Transition Zone.

This species occurs throughout the zone of juniper and pinyon and far up into the Canadian Zone in the drier areas of the latter. So few were seen about the ranch in the day time that we were surprised to find so many individuals of this flightless grasshopper coming to the lights at night. These became more and more frequent toward the end of the season. Like those of certain other species, individuals may become restless with the advent of cold weather, moving about more than when their food is growing and fresh and the weather is more favorable.

Chimayo and the ridge between Rio en Medio and Chupidero Canyons in the Sangre de Cristo Range are eastern limits for the species.

**Melanoplus bohemani** (Stål). C. H.

Our assignment of this insect to racial position under *dodgei*<sup>10</sup> in 1929 is shown by study of the penis of the members of this, the Dodgei Group, to be incorrect, the present being a distinctive valid species.<sup>11</sup>

Santa Fé Baldy, Sangre de Cristo Range, 12100 to 12300 feet, August 1, 3 ♂, few in lush Arctic Alpine herbage above timber line, with *borealis stupefactus*, which insect was there decidedly the more numerous. Foot of saddle, Nambe Divide, Sangre de Cristo Range, 10700 feet, August 12, 5 ♂, 1 ♀, occasional in Hudsonian Zone lush herbage (in prostrate fire-killed spruce forest), with *borealis stupefactus*, which insect was there decidedly more numerous. Upper canyon of Rio en Medio, Sangre de Cristo Range, 9400 feet, August 22, 1 ♀ seen but not taken, scarce in undergrowth of Aspen and conifer forest. Aspen Ranch, Rio en Medio, Sangre de Cristo

<sup>10</sup> The numerous New Mexican records there given are all correct except for the series of very small immatures from the summit of Santa Fé Baldy, which are referable to *borealis stupefactus*. When found at the same spot even adults of these two species are very similar, except for the very different male genitalia.

<sup>11</sup> The same is true in the case of *huron* Blatchley, a species which is as yet not known from Colorado as our series reported in 1929 from Fisher's Peak (recorded as *dodgei bohemani*) and from Glenwood Springs (recorded as *dodgei bohemani* diverging toward *dodgei huron*) being actually referable to *dodgei*, but atypical and representing either a striking environmental adaptation or an undescribed geographic race.

Range, 9000 feet, July 26, 1 ♂, 1 ♀, one small colony found in undergrowth of Aspen forest.

This insect is scarce in the Sangre de Cristo Range from the middle of the Canadian Zone (where it occurs in the forest undergrowth) up into the Arctic Alpine Zone (just above timber line), but it does not reach the very summit of either Santa Fé Baldy or Lake Peak, *borcalis stupefactus* alone having that distinction. A southern limit for the species is Clouderoft in the Sacramento Mountains (at 8000 feet), recorded as the synonymous *altitudinum* by Rehn in 1902 and by Rehn and Hebard in 1909.

**Melanoplus splendidus** Hebard. U.

This handsome insect was previously known only from the small original series, described in 1920, taken in the Jemez Mountains and at Jemez Hot Springs, New Mexico, at from 6400 to 7500 feet.

Rancho del Monte, 7000 feet, the following attracted to light at night, July 12, 1 ♀ (apparently injured by the beak of a bird); July 13, 1 ♀; July 16, 1 ♂ which came in with great leaps early in the evening and 1 ♀ on porch window screen; July 17, 1 ♂; July 19, 1 ♀; July 21, 1 ♀ probably attracted to the lights the previous night, on kitchen screen in early morning. The following were taken by daytime search, July 13, 2 ♂, 1 ♀, these were perched on the twigs just before the terminal bunches of juniper foliage, all were easily taken by a quick grasp after the thumb and fore finger had been very slowly and steadily brought to within grasping distance, all were found in an area less than fifty yards in diameter, singly, by examining thoroughly about thirty bushes; July 14, 1 ♀, after careful examination of at least forty junipers, on twig before terminal bunch of foliage six feet from ground; July 17, 1 ♀, flew out of the lower portion of a juniper onto the bare ground; July 23, 1 ♂ on adobe wall of house five feet from ground in shade just before noon. Taken by night time search with an electric torch, July 14, 2 ♀ (one still teneral) after examining thoroughly about seventy junipers; August 29, 1 ♀ clinging to stem of juniper near top-most bunch of foliage. A total of five males and eleven females was taken. The species apparently reaches its maximum adult abundance about the middle of July. We were surprised to find how extremely scarce it became soon after that period.

The teneral specimen taken on July 14 was kept alive on juniper for eight days, then pinyon for four days when it ate the bark of the twig and then chewed the twig through, then short grass of this environment which it ate sparingly and again juniper which it ate vigorously, remaining in excellent condition throughout this period. It ate the ends of the juniper foliage, but when eating the needles of the pinyon and blades of grass it cut through them instead. It was apparently more active and ate more by night than by day. We believe that a considerably larger series could

have been more easily secured had we known this earlier and searched for individuals feeding at night on the junipers with the aid of an electric torch.

**Melanoplus bivittatus** (Say). U. T. C.

Chimayo, 7000 feet, August 8, 1 ♀ only in irrigated area. Ridge between Rio en Medio and Chupidero Canyons, Sangre de Cristo Range, 9100 feet, July 23, moderately common in open and in dry undergrowth of aspen forest. Chupidero Canyon, Sangre de Cristo Range, 8450 feet, July 23, 1 ♂, scarce in green grassy openings in Canadian Zone forest. Otowi railroad station, 5825 feet, August 31, 1 ♀ only in green marsh grasses and burdocks.

Generally distributed in the Canadian Zone, this species occurs in the zone of juniper and pinyon only in the green vegetation of irrigated areas and near water.

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Material of *Melanoplus differentialis* (Thomas) is before us from Jemez Hot Springs and Albuquerque, New Mexico. The species is, therefore, almost certain to be found in irrigated areas in the Upper Austral Zone of the region here under consideration.

**Melanoplus dawsoni** (Scudder). C.

Ridge between Rio en Medio and Chupidero Canyons, Sangre de Cristo Range, 9100 feet, July 19, 1 ♂, 1 ♀ (both brachypterous), small numbers in dry undergrowth of Aspen forest.

This is strictly a species of the Canadian Zone. The above is a southern limital record for this boreal grasshopper.

**Melanoplus confusus** Scudder. T. C.

Ridge between Rio en Medio and Chupidero Canyons, Sangre de Cristo Range, 9100 feet, July 19, 1 ♀; July 22, 1 ♂, very scarce in short dry grass and mountain flowers of open area, Canadian Zone.

This species appears adult in the Spring and, like *Xanthippus corallipes leprosus*, had almost disappeared before we collected in the region which it inhabits. Rehn in 1904 recorded this insect as *minor*, a preoccupied name, from Pecos, New Mexico, a southern limital point in the very extensive range of the species.

**Melanoplus femur-rubrum femur-rubrum** (DeGeer). U. (T.) C.

Taos, 7000 feet, August 16, 1 ♂ (small and slender), common in open area with much Tumble Weed. Chimayo, 7000 feet, August 8, 1 ♂, very common in alfalfa and lush weeds along irrigating ditch. Aspen Ranch, Sangre de Cristo Range, 9000 feet, July 26, 1 ♂ (not kept), in lush Canadian Zone vegetation on bank of the Rio en Medio, only one seen.

This was the most numerous species along the irrigated areas of the Rio Tesuque and is probably generally so in similar environment throughout the

Upper Sonoran Zone. In the Canadian Zone of New Mexico, however, it is probably very rarely present.

**Melanoplus borealis stupefactus** (Scudder). C. H. A.

Revision of the Borealis Group will be necessary before we can feel certain as to the number of species and races there represented. Examination of the penis now shows that this organ is of the same general type in all of the recognized races but shows distinct proportionate differences in some.

Summit of Santa Fé Baldy, Sangre de Cristo Range, 12629 feet, August 1, 2 ♂, 5 ♀, the only orthopteron present, in small numbers and about two-thirds still immature, in patches of green Arctic Alpine vegetation among rocks. These became increasingly more abundant down to timber line on the eastern ridge at 12300 feet, where the majority were adult. The species was also numerous in the lush Hudsonian Zone herbage on this ridge from 12300 to 12100 feet, (5 ♂, 11 ♀, 1 juv. ♂, 3 juv. ♀ taken). Foot of Saddle, Nambe Divide, Sangre de Cristo Range, 10700 feet, August 12 and 18, 6 ♂, 5 ♀, 1 juv. ♂, generally distributed in small numbers in Hudsonian Zone herbage. Summit of Lake Peak, Sangre de Cristo Range, 12376 feet, August 12, 1 ♀ only in scanty grass among topmost crags.

This insect occurs from the colder portions of the Canadian Zone up to the mountain summits in the very restricted Arctic Alpine Zone of the Sangre de Cristo Range and is, we believe, with *M. o. occidentalis* and *M. m. mexicanus*, the only species of grasshopper which is present above timber line in these mountains.<sup>12</sup>

Beulah and the headwaters of Chupidero Creek at 8500 feet are southern known points in the distribution of this insect, established synonyms of which, based on New Mexican material, are *cockerelli* and *sapellanus*.

**Melanoplus occidentalis occidentalis** (Thomas). U. (T.) (C.) H. A.

Santa Fé Baldy, Sangre de Cristo Range, 12623 and 12300 feet, July 27, 1919, (M. Hebard; one at summit, one at timber line in herbage of Arctic Alpine Zone), 2 ♀; 12000 feet, July 27, 1919, (M. Hebard; in herbage of Hudsonian Bone), 1 ♂, 2 ♀. Tesuque Creek, 7900 feet, July 28, 1919, (Rehn and Hebard), 2 ♂, 1 ♀. Rancho del Monte, 6950 feet, July 12, few in areas of short parched grass on flat of abode and gravel in zone of juniper and pinyon. Cuyamungue, 6300 feet, July 12, 3 ♂, 2 ♀, in great numbers particularly on small tufts of a composite growing on an adobe flat.

The specimens from high elevations are considerably larger than the others here recorded.

<sup>12</sup> The very small immature specimens recorded by us as *dodgei bohemani* in 1929 from the summit of Santa Fé Baldy are referable to the present species. Also see accidental occurrence there of a specimen of *Hesprotettix viridis viridis*, recorded in the present paper.

This species is found at high elevations elsewhere; a pair was recorded by us from Pike's Peak, Colorado at timber line (12230 feet), in 1929.

This very widespread western species is known in New Mexico as far south as the Magdalena Mountains and Silver City <sup>13</sup> (type of the synonym *cuneatus* Scudder).

**Melanoplus fasciatus** (F. Walker). C.

Tesuque Creek, Sangre de Cristo Range, 7900 feet, July 27 and 28, 1919, (Rehn and Hebard; in strawberry plants and grasses under conifers on lower edge of Canadian Zone), 1 ♂, 1 ♀.

The Sandia Mountains in New Mexico constitute a southern limit for this boreal species, published by Hebard in 1928.

**Melanoplus mexicanus mexicanus** Saussure. U. (T.) C. H. A.

Santa Fé Baldy, Sangre de Cristo Range, 12300 feet, July 27, 1919, (M. Hebard; in Arctic Alpine herbage at timber line), 1 ♀; same, 12000 to 11000 feet, 1 ♀. Head of Chupidero Creek, Sangre de Cristo Range, 8500 feet, July 27, 1919, (M. Hebard; in Canadian Zone), 1 ♀. Tesuque Creek, Sangre de Cristo Range, 7900 feet, July 27 and 28, 1919, (Rehn and Hebard; in Canadian Zone), 1 ♂, 1 ♀, 1 juv. ♀; 7000 feet, same, 1 ♀, in Upper Sonoran Zone. Chimayo, 7000 feet, August 6, very few in alfalfa and lush weeds along irrigating ditch. Cerrillos Mine, 6000 feet, August 4, 1 ♀, only specimen seen on plains of short grass.

We also saw occasional individuals of this species on the Rio en Medio and Chupidero Creeks in the Sangre de Cristo Range up as high as 8500 feet, but it was never other than very scarce there at all stations examined.

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The invasions of *Melanoplus mexicanus* in its migratory phase *spretus* (Walsh) undoubtedly covered the area under consideration. As to the invading swarms, Scudder quotes, "the farthest point south to which they flew was one hundred and forty miles south of Santa Fé". None were seen by Cockerell during the years subsequent to 1893, while he was a resident in New Mexico and during that time all reports of injury by grasshoppers proved due to resident species. There are, however, many records of its presence in northern New Mexico from 1865 to 1878.

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As *Melanoplus bruneri* Scudder C. has been found as far south as Beulah (Scudder and Cockerell, 1902) and at timber line on Truchas Peak, 13000 feet (Rehn as the synonym *excelsus*, 1904) it may well occur in the Canadian and Hudsonian Zones of the southern portion of the Sangre de Cristo range. Beulah and Agua Fria Park at 8800 feet (Scudder and Cockerell, 1902 as *excelsus*) are eastern limits in New Mexico.

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<sup>13</sup> No material from Zacatecas is in the Bruner Collection and we believe this single Mexican record (by Bruner as the synonym *flabellifer*) is incorrect.

**Melanoplus foedus foedus** Scudder. U.

Taos, 7000 feet, August 16, 3 ♂ (caudal tibiae pink), moderately numerous in open among tumble weeds, but particularly in tangles of green weeds and along stream. Three miles south of Santa Cruz, 5987 feet, August 15, 1 ♀ (caudal tibiae pink). Tesuque Creek, 7400 feet, VII, 28, 1919, (Rehn and Hebard; few in areas of tall weeds), 1 ♂.

**Melanoplus packardii** Scudder. U.

Tesuque, 6800 feet, July 12, 1 ♀ (caudal tibiae pink), common in Alfalfa.

This and Jemez Hot Springs are southern limits of distribution in New Mexico.

**Melanoplus angustipennis** (Dodge). U.

Chimayo, 7000 feet, August 8, 1 ♂, 1 ♀ (caudal tibiae glaucous), in irrigated area.

This is a southern limital point.

**Melanoplus bowditchi bowditchi** Scudder. U.

Chimayo, 7000 feet, August 8, 1 ♂, in irrigated field among lush green weeds and alfalfa with a few scattered gray-green composites. Chamita, 5925 feet, September 3, 1 ♀, in rabbit weed in wash. Three miles south of Santa Cruz, 5900 feet, August 15, 8 ♀, occasional in scattered rabbit weed along wash. Pojoaque, 6150 feet, August 13, 2 ♂, only seen in rabbit weed in wash. Rancho del Monte, 7000 feet, July 11, 1 ♂, on flat of parched short grass with very small clumps of rabbit weed. Otowi railroad station, 5825 feet, August 31, 1 ♀, only one seen in rabbit weed on gravelly adobe wash.

These specimens are quite constant in appearance but quite different from the normal for *bowditchi bowditchi* in Colorado and Nebraska. The present condition appears to be quite widely distributed to the south. It may prove to represent a race quite as well defined as *bowditchi canus* of the sage-brush plains in the north. No differences are shown by the penis. We do not feel however that recognition of a race would be justified until all of our material of this difficult group has been studied and a revisionary report prepared.

We are inclined to believe that this insect reaches its maximum adult abundance in June or early July.

**TETTIGONIIDAE****PHANEROPTERINAE****Arethaea gracilipes gracilipes** (Thomas). U.

Mesa north of Rio en Medio, 7000 feet, August 15, 1 ♂ in tuft of short parched grass among junipers. Rancho del Monte, 7000 feet, July 11, 1 ♂ in tuft of short parched grass among junipers; July 26, 1 ♂ flew on wind

shield of car while running slowly at night; July 28 to September 2, 6 ♂ at light at night. Tesuque Creek, 7200 feet, July 28, 1919, 1 ♂, in dry tuft of grass among junipers.

Not at all common in this area the insect remarkably blends with the tufts of short parched grass in the zone of juniper and pinyon in which it lives.

Tesuque Creek, Jemez Hot Springs and Fort Wingate, New Mexico are northern limits for this race, which to the east, however, reaches as far north as Trinidad, Colorado.

***Insara juniperi***, new species. U. Text-figures 1 and 2.

This species is nearest *covilleae* Rehn and Hebard, differing in the more robust form, somewhat shorter organs of flight and limbs, less strongly sellate pronotum with shorter lateral lobes and very different marking.

The tegmina instead of having a row of large pale spots show a herring-bone pattern somewhat suggesting that found in *elegans elegans* (Scudder) but the general green coloration is decidedly deeper and the veins of the tegmina are more extensively and more broadly pale particularly toward their sutural margins. The limbs are weakly bicolored, not very strikingly and broadly annulate as in *covilleae* or immaculate as in *elegans*.

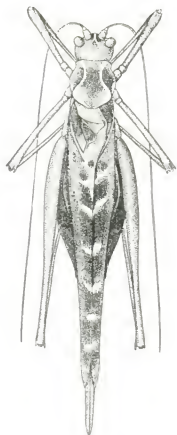


FIG. 1.—*Insara juniperi*.  
Male Type. (+ 2½)

*Type*: ♂; Rancho del Monte, Santa Fé County, New Mexico. Elevation 7000 feet. August 29, 1934. (M. Hebard and M. Hebard, Jr.) [Hebard Collection, Type No. 1275.]

Size rather small for the genus, form rather robust, the abdomen in life being short and extremely inflated. Head slightly broader than in *elegans*; eye prominent, elongate, nearly oval, almost vertical; vertex similar to that of the related species, declivent, this strongest proximad, its dorsal surface very narrow and sulcate. Pronotum short, with dorsum weakly sellate, lateral carinae coarsely and weakly indicated, cephalic margin very weakly concave, caudal margin broadly convex with flattening of the convexity shown on each side, lateral lobes with greatest depth equal to greatest width, the humeral sinus large, deep, concave, its margins perpendicular to each other, below this the ventro-caudal portion is roundly produced ventro-caudad, that section occupied by a large convex callosity. Tegmina narrow with apices rounded, marginal field narrowing (less rapidly than in *covilleae*, more rapidly than in *elegans*) and disappearing mesad. Wings extending well beyond tegmina. Dorsal abdominal tergites pinched meso-distad but not produced.

Genitalia much as in the related species. Disto-dorsal tergite with a large meso-distal depressed area. Supra-anal plate small, triangular. Cerci tapering, slightly curved but definitely bent inward mesad, just before apical tooth impressed dorsad, tooth small acute triangular, directed dorsad and slightly distad. Subgenital plate with short non-articulate styliform appendages and with distal margin slightly and bluntly produced mesad between these. Limbs comparatively short. Cephalic tibiae enlarged proximad with both large tympana apert, narrowing gradually distad of these. Genicular lobes of cephalic and median femora bidentate. Ventral femoral margins unarmed. Very important diagnostic characters shown by color pattern.

*Allotype*: ♀; same data as type but taken August 24, 1934. [Hebard Collection.]

Very similar to male, larger and form somewhat more attenuate. Ovipositor comparatively large, deep, particularly at base where it is strongly bent dorsad, margins beyond converging very weakly then curving to apex; dorsal margin armed with minute triangular teeth which increase in size distad, ventral margin so armed only distad; lateral surfaces of dorsal valves microscopically acutely tuberculate, of ventral valves showing microscopic vertical ridges dorsad, these becoming weaker and general distad.

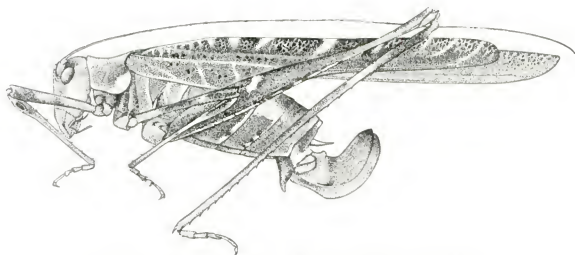


FIG. 2.—*Insara juniperi*. Female *Allotype*. (+ 2½)

General coloration in dorsal aspect bright cedar green, the face and sides slightly paler (peacock green), with the following markings. Eyes wood brown. Antennae light green, distad with irregular annuli, some very short and dark brown, others longer and light brown. Head with all of vertex, vertical facial carinae broadly, an extensive sub-ocular area and a narrower post-ocular suffusion warm buff. Pronotum with lateral carinae of disk warm buff, caudal margin laterad white, this entire area preceded by a rather broad suffusion of rusty brown; lateral lobes with convex callosity very conspicuously white. Tegmina with cross-veins buffy, those running to sutural margin more broadly so and there including the proximal portions of the cross-veinlets; very numerous microscopic black dots present in dis-



coidal field among the numerous network of green veinlets particularly toward the sutural margin, very few in the marginal field; male stridulating field tinged with brown proximo-laterad and a large black dot at its apex caudad. Abdomen (from life) green, with first exposed tergite showing a greenish-buff area on each side which is continued on the next tergite to a pre-marginal narrow blackish area, the caudal margin of that tergite narrowly buffy to near the median section, this line breaking into dots on the sides; a large dorso-lateral buffy area on the next tergite, this and the following tergite with caudal margins narrowly buffy laterad. Ventral sternites green with a fine elevated shining white median line on each side of which is a row of fairly large irregularly rounded buffy areas and then a row of even larger buffy longitudinal areas alternating with these. Thus when seen from above or below this insect's broken up and streaked markings conceal it very completely in the foliage of the junipers.<sup>14</sup> Ovipositor red brown at apex. Cephalic and median limbs extensively but very vaguely and not conspicuously annulate with whitish green; caudal femora cedar green washed dorso-proximad with whitish and a large fleck of the same dorso-mesad on the external surface, ventro-external margin sometimes paler and whitish green with inconspicuous and irregular flecks of slightly darker green, caudal tibiae with a broad but not conspicuous annulus of whitish green. Feet green with joints ventro-laterad olivaceous and darker.

The extremes in the present series measure as follows: length of body ♂ 15.5 to 17, ♀ 16.7 to 19.3; length of pronotum ♂ 3.6 to 3.7, ♀ 3.6 to 3.7; length of tegmen ♂ 20 to 21.8, ♀ 23 to 24.3; post-median width of tegmen ♂ 2.3 to 2.7, ♀ 2.7 to 2.8; projection of wing beyond tegmen ♂ 4 to 4.1, ♀ 4.2 to 4.3; length of caudal femur ♂ 15.7 to 17.3, ♀ 18.5 to 19.7; length of ovipositor 5.2 to 5.3 mm.

The eggs are black, measure 5 by 2.1 mm., with dorsal margin broadly convex, ventral margin very weakly convex, bluntly rounded at one end and at the other with dorsal margin curving down to a very small rounded projection at the juncture with the ventral margin.

The first specimen seen, which came to light on the night of August 10th, showed almost unmistakably from its color and markings that it was an inhabitant of the junipers, but how to find additional material was a decided puzzle as these shrubs are too stout and stiff to permit ordinary beating with a net and no stridulation was heard. A week later two females were accidentally found on a juniper at night, but it was not until the twenty-fifth that my son accompanied me on a search through the junipers after dark. His sharp ears instantly detected the exceedingly faint stridulation of males on all sides, which proved so numerous that time alone prevented the capture of many. Soon after the number considered particularly needed had been traced by their stridulation and secured (by the twenty-ninth) cold weather preceding and following that date prevented further search on many nights and the few favorable evenings prior to our departure on

<sup>14</sup> The marking of the ventral surface of the abdomen is lost in practically all dried specimens. The body and limbs sometimes also become brownish buff in drying.

September 8th were taken up largely with search for other species of which sufficient series had not been obtained. Deliberate approach and careful search alone is necessary, as a male could be heard on favorable evenings on approximately one out of the twenty-five nearest junipers over a large area about the ranch house. As I was able to hear the stridulation of such insects as *Cycloptilum* and *Hoplosphyrum* at a distance of thirty to forty feet, I was much surprised to find the song of *Insara juniperi* so faint that I could frequently not detect the singing when only a few feet distant. This song somewhat resembles the rapid clicking of the teeth of a mouse sometimes heard when it is feeding; at other times a series of very faint whirrs are given.

In addition to the type and allotype, fifteen males and eight females bearing the same data but taken from August 10 to September 6 are designated paratypes.

We are describing a closely related species from northwestern Arizona in a paper which will shortly be published.

***Scudderia furcata furcifera*** Scudder. U. (T.)

Rancho del Monte, 7000 feet, August 25, 1 ♂ (atypical) attracted to light at night.

This insect is probably present only in green herbage and deciduous shrubs and trees in the vicinity of water courses. Most of our night work was done far from such in the typical arid environment of junipers, which probably explains why only one specimen was seen.

#### COPIPHORINAE

Rehn recorded *Neoconocephalus ensiger* (Harris) [U.] [T.] [C.] from the Rio Grande in New Mexico in 1904 (referring it to *Conocephalus* as was then customary). The author secured a series of this northern species, much to his surprise, at Albuquerque, 4943 feet, on August 17, 1921, in marshy areas at night, the song noted as a loud incessant dzee-dzee-dzee-dzee. Individuals were not alert and were quite easily secured. This is a southwestern limit, a northwestern limit being Julesburg, Colorado. The species will therefore probably be found in the upper Rio Grande valley and the mountain valleys of Colorado, though throughout those regions we have neither seen or heard it.

#### CONOCEPHALINAE

Material considered intermediate between the eastern *Conocephalus fasciatus fasciatus* (DeGeer) [U.] [T.] [C.] and the western *Conocephalus fasciatus vicinus* (Morse) was recorded from the Jemez Mountains and Jemez Hot Springs, New Mexico, by Rehn and Hebard in 1915. Though we did not see the species it is certainly present and probably locally common in the irrigated areas of the upper Rio Grande valley.

## DECTICINAE

**Capnobotes occidentalis** (Thomas). U.

Rancho del Monte, 7000 feet, July 11 to August 18, 10 ♂, 6 ♀, 1 large juv. ♀, (six males and two females green, the others brown), six in junipers, two taken from pinyon, one drowned in swimming pool, and eight at light at night, one of the latter, the immature female, on the screen of a second-floor window.

This species was at its maximum adult abundance upon our arrival on July 11 and was heard on all sides in the junipers until the end of the month but the number of singers steadily diminished. In August very few were to be heard and we were surprised to find a single male stridulating bravely as late as August 29. It is clear that, contrary to our previous impression, this is not a species which appears adult late in the season but one which probably occurs adult early in June. In early July it was far more abundant than we had ever previously found it and it is probably more common over its extremely wide range than we had supposed. On July 11 as many as six or seven males could be heard stridulating after dark, usually in the topmost tufts of foliage of the low junipers in a circle of not more than one hundred feet about the ranch house. This is the most alert and wary orthopteron we have ever collected, showing at times actions almost suggesting actual intelligence.

The males, while resting or moving very slowly about on the topmost tufts of foliage, stridulate without pause, when once started, with tegmina then only slightly raised and kept in a continuous spasmodic fluttering. The note produced is not loud, scarcely audible at over fifty feet, and has an exceptionally ventriloquistic quality. The green phase blends quite as remarkably with the green foliage of the juniper as does the gray phase with the gray bark of that shrub and if a singer is not located to almost its exact position before it becomes silent it is almost impossible to find. Some individuals were found to be much more alert than others and were much more apt to be startled by an incautious approach than by the rays of the electric torch, which at times could be played directly on a singer without its giving the brilliant light any notice. When individuals came to the light at night they were invariably very alert and active, jumping and flying vigorously if not approached with extreme caution.

This is a northeastern and Pecos, New Mexico, a southeastern limit for the species.

**Anabrus simplex** Haldeman. C.

Ridge between Rio en Medio and Chupadero Canyons, Sangre de Cristo Range, 9100 feet, July 27, males stridulating and moderately common in bushes in open area on summit, but so wary that none could be located, 1 ♀ (green) found walking across open. Aspen Ranch, Sangre de Cristo Range, 9000 feet, July 27, males stridulating and moderately numerous in bushes.

Beulah (recorded as the synonym *coloradus* by Seudder and Cockerell in 1902) and the above constitute southern limit records.

**Eremopedes scudderi** Cockerell. U.

Pojoaque, 6150 feet, September 2, 1 ♂, stridulating very faintly (detected by M. Hebard, Jr.) and intermittently although it was very warm, at night in middle of close topmost clump of spines and foliage of *Sarcobatus vermiculatus*.<sup>15</sup> Abandoned pueblo southwest of Rio en Medio on mesa, 7100 feet, August 29, 1 ♀, only individual seen in parched short grass among junipers. Rancho del Monte, 7000 feet, July 8, 1 juv. ♀ in house at night undoubtedly attracted to light on porch; August 19, 1 ♂ in top clump of foliage of very low juniper resting head downward, very cool evening at 9:30 P. M., temperature 64°.

These specimens are extremely small for the species. All are gray brown marked with whitish.

Northern limits are Rio en Medio and Pojoaque, but to the east the species occurs as far north as La Junta, Colorado. Western limits are Pojoaque, Albuquerque and Mesilla Park, New Mexico.

#### STENOPELMATINAE

**Stenopelmatus fuscus** Haldeman. U.

Rancho del Monte, 7000 feet, August 14, 1 ♂ climbing up adobe wall toward light at night; September 6, 1 ♀ with full sized eggs, size decidedly smaller than male, on ground under powerful electric light at night, resting motionless until seized. We believe that these individuals came to the light at night upon seeing insects fluttering about it and that they themselves were in no way dazzled.

The male, when grasped by the head, was so powerful that with all feet in action it was difficult to hold. When dropped into a net it first tried to bite viciously, then running about rapidly it would kick violently and repeatedly with its caudal limbs when fearing attack from the rear, this bringing into action the formidable spurs of the caudal tibiae. We had not before realized how vigorously this insect can defend itself. Biting and kicking powerfully it would undoubtedly discourage a mouse or other small creature, to which its large soft body would otherwise prove a luscious feast.

#### RHAPHIDOPHORINAE

**Phrixocnemis neomexicanus** (Seudder). (T.) C.

Tesuque Creek, Sangre de Cristo Range, 7900 feet, July 27, 1919, (M. Hebard; on road at night in lower edge of Canadian Zone forest with the aid of an electric torch), 1 adult.

<sup>15</sup> This *Sarcobatus* flat was visited to see if *Plagiostira albonotata* were present, but none were heard or seen.

We did not see this insect in the season of 1934, due certainly to the fact that opportunity did not offer to do night work in the Canadian Zone.

The Albuquerque specimen (probably from the adjacent Sandia Mountains) recorded as *Udcopsylla robusta* by Scudder and Cockerell actually represents the present species and it is probable that the same is true for the specimen from [the mountains near] Santa Fé, recorded by them as *Udeopsylla nigra* (established as a synonym of *robusta* by Hebard in 1925).

Chama, New Mexico is a northern and eastern limit and the above and Clouderoft in the Sacramento Mountains, New Mexico, are eastern and southeastern limits respectively.

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As *Daihiniodes hastiferum* (Rehn) has been recorded from Kennedy, New Mexico, at 6008 feet, a locality just south of Santa Fé, the species may be present anywhere at the lower elevations in the region under consideration.

**Ceuthophilus utahensis** Thomas. C. H.

Lake Peak, Sangre de Cristo Range, 12380 feet, August 12, 1 small juv. ♀, considerable search under half-buried granite rocks on the immediate summit revealed only this one specimen.

In 1919 the following additional material was secured nearby in the Sangre de Cristo Range. West slope of Lake Peak, 10000 to 11000 feet, July 28, (M. Hebard; under bark of firs in Hudsonian Zone forest), 3 juv. ♂. Tesuque Creek, 7900 feet, July 27 and 28, (Rehn and Hebard; under bark of logs and stumps of Canadian Zone forest and five females there on road at night with aid of electric torch), 6 ♀, 4 juv. ♂.

This species has been previously recorded from Beulah, Las Vegas Range and from Clouderoft in the Sacramento Mountains at 8600 feet as *uniformis* and as *valgus* and from Santa Fé (certainly from the adjacent Sangre de Cristo Range) and the White Mountains as *valgus*. It is by far the most abundant species of the genus in the Rocky Mountain uplift of this region from the lower edge of the Canadian Zone up to the mountain summits through the Hudsonian Zone.<sup>16</sup>

**Ceuthophilus** nearest *arizonensis*. U.

Rancho del Monte, 7000 feet, September 1, 1 ♂ at night on adobe wall upon which some light was shining. Tesuque, 6800 feet, September 6, 1 ♂ at night on road beside irrigating ditch with aid of electric torch.

This is a small, very distinctive species, shortly to be described by Hubbell from southeastern Utah.

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<sup>16</sup> We believe that this Zone reaches the very summit of Lake Peak, the Arctic Alpine Zone appearing on Santa Fé Baldy only over the small area above 12300 feet (timber line), where no *Ceuthophili* were found.

Like most of the specimens of *pallidus* which we secured, these were motionless until the cyanide bottle had been cautiously put over them, but the instant antenna, limb or body is touched they spring about with tremendously vigorous and rapid erratic leaps.

**Ceuthophilus nearest secretus.** U.

Tesuque, 68000 feet, September 6 and 7, 3 ♂, 1 very small juv. ♂, 1 very small juv. ♀, about ranch house at night with aid of electric torch, one on ground beside adobe wall of house under vines, others on adobe walls.

This was evidently the most numerous species of the genus at this spot, which is surrounded by an irrigated orchard, trees and green vines.

The species, common on the plains of western Oklahoma and Texas, will shortly be described by Hubbell.

**Ceuthophilus pallidus** Thomas. U.

Rancho del Monte, 7000 feet, July 14 to September 6, 11 ♂, 22 ♀. Tesuque, 6800 feet, September 7, 1 ♀, on adobe road in orchard after dark with aid of electric torch.

This was by far the commonest species of the genus, though never abundant, in the vicinity of the ranch house in the dry typical Juniper and Pinyon Zone environment of the first locality. All were taken singly, the first on adobe walls at light but later individuals were found more frequently by searching with the electric torch along adobe walls and the bases of tents in the dark, while a few were found high up on the former.

We believe that these almost omnivorous insects come to light attracted more by the presence of other insects which they may catch and eat than due to the fact that they may be dazzled. This, we believe, was similarly the case with *Stagmomantis limbata* and *Stenopelmatus fuscus*.

The dark checkering overlaying the pale coloration of this insect is very conspicuous but serious discoloration is very apt to occur in drying and much the best way to preserve it, we are convinced, is thorough evisceration and stuffing with a bit of cotton. The size variation in the series is not very great, the majority being small for the species and only one male (July 29) and the Tesuque female being fairly large.

**Ceuthophilus related to silvestris.** U.

Rancho del Monte, 7000 feet, August 30, 1 very small ♀, climbing about rapidly on adobe wall at a light eight feet above the ground at night; August 31, 1 large ♂, on adobe wall close to ground at night, everything wet from showers and temperature down to 60°; September 1, 1 medium sized ♀, on adobe wall at night where some light was shining on it.

## GRYLLIDAE

## GRYLLINAE

**Gryllus assimilis** (Fabricius). U. (T.) (C.)

Rancho del Monte, 7000 feet, 1 ♀ at night on bank of arroyo. During our entire stay, July 11 to September 8, males of a few small colonies could be heard stridulating, particularly in the evening, in the banks of nearby arroyos. In early September small immature individuals were frequently seen running over the ground at night.

## NEMOBIINAE

**Nemobius** sp. (probably **fasciatus**). U. (T.) (C.)

Males were trilling vigorously in the green grasses beside an irrigating ditch, but none were located in the little time available September 7th.

## OECANTHINAE

**Oecanthus niveus** (DeGeer). U.

Rancho del Monte, 7000 feet, August 14, 1 ♀ at light at night. Tesuque, 6800 feet, September 6, 2 ♂ traced at night, one in apple tree, one in vine on ranch house; song continuous, rich and evenly undulating. Mesa two miles north of Frijoles Canyon, Sandoval County, 8000 feet, August 30, 2 ♀ beaten from scrub oaks in Western Yellow Pine forest growing on volcanic sands and pumice.

This species is quite common in the green foliage of trees and vines in irrigated areas and was also heard at the Bishop's Lodge, at 7200 feet.

**Oecanthus nigricornis quadripunctatus** Beutenmuller. U.

Rancho del Monte, 7000 feet, August 13, 1 ♀ at light at night; September 5, 1 ♂ stridulating in rabbit weed among junipers at night, located with electric torch by M. Hebard, Jr. Pojoaque, 6150 feet, September 2, 1 ♂ stridulating on Burdock on adobe flat at night, located with electric torch by M. Hebard, Jr.; the species numerous there.

This common species is probably quite generally distributed through the zone of juniper and pinyon in this region.

**Oecanthus californicus pictipennis**, new subspecies. U. Text-figure 3.

Immediate habitat appears to be a factor in the development of this condition, which occurs over a comparatively small area in the very extensive distribution of this species.

It is a development in many ways very similar to *Oecanthus nigricornis nigricornis* which occurs locally only over part of the eastern United States, whereas *nigricornis quadripunctatus* is generally present there and also reaches far west of the typical condition.

Type: ♂; Rancho del Monte, Santa Fé County, New Mexico. Elevation 7000 feet. August 11, 1934. (M. Hebard.) [Hebard Collection, Type No. 1276.]

Differs only from males of typical *californicus* in coloration and showing a striking tegminal color pattern.<sup>17</sup> Caudal femora and sides of tegmina rich clear green. Other femora paler green; tibiae the same, the cephalic but the particularly the median suffused. Sides of abdominal sternites dark purplish brown, this also suffusing the mesosternum and metasternum, soft integument between sternites and tergites of abdomen strikingly purplish pink. Head deeper purplish pink paling toward mouth. Pronotum and proximal portions of tegmina rich clear green, the tegmina weakly but conspicuously suffused with clove brown rather broadly along the principal oblique vein, the two oblique veins which cross the tympanum, the margin of the dorsal field except in all but the distal portion of the anal field and all but the proximal three-fifths of the elongate submarginal open area toward the sutural margin. This coloration is shown in life, dried specimens with greens becoming rapidly weak or pale yellowish and purples much less brilliant. Often the head and pronotum mesad and laterad are suffused with brown, but such also sometimes occurs in the typical condition. The blackish vertical streak near and paralleling the inner margin of the first antennal joint ventrad varies from obsolete to heavy, in most specimens being very faintly indicated.

Females, of which one bearing the same data as the type but taken August 15 is selected allotype, are distinguished from the typical condition when dried only by the greenish veins of the dorsal tegminal field, but as these apparently often in time fade to yellowish, it is probable that material of this sex can not always be separated.

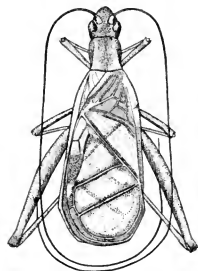


FIG. 3.—*Oecanthus californicus pictipennis*. Male  
Type. (+ 3)

	Length of pronotum	Width of pro- notum <sup>18</sup>	Length of tegmen	Width of tegmen	Length of caudal femur
♂					
Rancho del Monte, N.M. ...	2.34 to 2.4	2.4 to 2.55	10.6 to 11.9	5.3 to 5.7	8.1 to 8.8
Jemez Hot Springs, N.M. ...	2.12	2.5	11.2	5.3	8.
Pink Hills, Utah .....	1.98 to 2.	2. to 2.3	9.2 to 10.7	4.7 to 4.9	7.1 to —
Kaibab Plateau, Ariz. ....	2.2	2.3	10.3	4.8	7.2
				Length of ovipositor	
♀					
Mesa Verde, Colo. ....	2.2	2.13	9.	5.7	8.
Rancho del Monte, N.M. ...	2.27 to 2.27	1.84 to 2.	9.4 to 9.8	6.1 to 6.6	8.7 to 8.8
Jemez Hot Springs, N.M. ...	2.5	2.34	11.	6.8	8.9
Pink Hills, Utah .....	2.1	1.9	8. to 9.3	5. to 5.8	7.8 to —

<sup>17</sup> The tegmina of all other species of North American *Oecanthus* are immaculate.

<sup>18</sup> This dimension is unsatisfactory, particularly for females, the pronotal lateral lobes flaring much more ventrad in some than in others, probably due largely to position when drying.



The loud continuous resonant trilling of this insect was first heard about the end of July, and a week later males were singing on all sides. It was clearly the most abundant orthopteron which sings at night in the juniper and pinyon zone and near our ranch house a male would be stridulating in about every sixth juniper. As is usual with the Oecanthinae, however, a singer is difficult to locate, on account of the ventriloquistic element, this mainly due to the different angles at which the two tegmina are held but partially to the fact that while singing an individual often shifts its position. Once it was known, however, that males when singing are usually perched near the tips of the bare dead twigs of the junipers far inside the foliage and near the trunks, usually only one to three feet from the ground, only time was needed to obtain as large a series as might be desired. Even then ten to twenty minutes might sometimes be necessary and some singers would remain silent so long after their first alarm (at even the most careful approach) that waiting to hear further stridulation in order to locate them would not be worth while. During our numerous searches for males only two females were seen, one of which was feasting on the secretions from the glands at the base of the dorsal surface of a male's abdomen while the latter rested motionless with uplifted tegmina. The entire series was found in junipers except one male which was on the leaves of a scrub oak sapling growing within a juniper and two females which came to light at night.

*Specimens Examined:* 55; 40 males, 14 females and 1 immature individual.

COLORADO. Mesa Verde, September 4, 1921, (C. D. Duncan), 1 ♀, [Hebard Cln.].

NEW MEXICO. Rancho del Monte, 7000 feet, August 11 to September 6, 1934, (M. Hebard and M. Hebard, Jr.), 31 ♂, 3 ♀, type, allotype and paratypes, [Hebard Cln.]. Jemez Hot Springs, August 6, 1911, (John Woodgate), 1 juv. ♂; August 29 to October 5, 1914 to 1917, (same), 6 ♂, 5 ♀, [A.N.S.P. and Hebard Cln.].

UTAH. Pink sand hills, road between Virgin River and Three Lakes, Washington County, 5750 feet, September 1, 1926, (Rehn and Hebard; in drooping sage brush, yucca and composites), 2 ♂, 5 ♀ very small, markings weak; typical *californicus* also present and also very small, [A.N.S.P. and Hebard Cln.].

ARIZONA. Northern slopes of Kaibab Plateau, 6700 feet, September 2, 1926, (J. A. G. Rehn; at light at night, camp in juniper, pinyon and rabbit brush of Upper Sonoran Zone), 1 ♂, [Hebard Cln.].

It is evident that Fulton had males of this condition from Durango, Colorado and [the Coconino Plateau at] the Grand Canyon, Arizona.<sup>19</sup>

<sup>19</sup> Oregon Agr. Exp. Sta., Bull. 223, p. 17. He there described and figured (figures SA to F) an apparently annectant condition between this and the typical insect from Corvallis, Oregon, of which a poorly preserved male from the same locality taken by Rehn and Hebard is in the author's collection.

A very large series of *californicus californicus* from western Texas, western Colorado, southern New Mexico, Idaho, southern Nevada, Arizona, western Oregon, and California, is before us, all the males of which have the tegmina immaculate, though very great variation in size and degree of tegminal development is shown.

#### MOGOPLISTINAE

**Cycloptilum comprehendens comprehendens** Hebard. U.

Rancho del Monte, 7000 feet, August 8 to August 18, 4 ♂, 9 ♀, at night on adobe walls of ranch house, the majority at light, a very few inside the house.

The frequent rapid ti-tee ti-tee ti-tee—ti-tee ti-tee ti-tee of this species was to be heard on all sides after the first of August from dusk until the night became rather chilly. The song is remarkably loud for so very small an insect. This was, after *Oecanthus californicus pictipennis*, decidedly the most abundant stridulating orthopteron in the zone of juniper and pinyon. The number of singers decreased much more rapidly than we expected from the very first chilly evenings of the early Fall.

The series is typical of this eastern race, for which this is a western limital point, though it is known northwestward as far as Farmington, New Mexico.

**Hoplosphyrum boreale** (Scudder). U.

Rancho del Monte, 7000 feet, August 8, 1 ♂ stridulating at night on adobe wall back of umbrella; August 24, 2 ♂ stridulating at night on adobe walls, located with electric torch.

Only a few other males were heard, while not a female was seen. About the first of September, during a period of decidedly chilly weather, two males could be heard, often in the daytime, between the ceiling poles within the ranch house, but neither could be located.

The singing is a continuous trill, suggesting that of *Gryllus assimilis*, but somewhat higher pitched and definitely not as loud, though of surprising volume for so small an insect. When stridulating the tegmina are elevated, almost vertical, with head and pronotum bent downward. This produces the same ventriloquistic quality found also in the song of the various species of *Oecanthus*.

Not only is this an eastern limit but also extends far north of any other point the known distribution of the species.

#### MYRMECOPHILINAE

As *Myrmecophila nebrascensis* Lugger [U.] has been taken at Santa Fé, we looked for it in a number of ant nests, but without success.

#### TRIDACTYLINAE

**Tridactylus minutus** Scudder. U.

Otowi railroad station, 5825 feet, August 21, 2 juv. ♀, moderately numerous on edges of wet spots along the Rio Grande.

This diminutive cricket is found only along the margins of permanent water.

SOUTH AMERICAN LAND AND FRESHWATER MOLLUSKS, IX.—  
COLOMBIAN SPECIES

BY HENRY A. PILSBRY.

The mollusks noticed herein are part of a lot received from Hmo. Apolinar Maria of Bogotá. Most of them are from places on the eastern flank of the Cordillera Oriental, eastward from Bogotá.

CAMAENIDAE

*Isomeria oreas* (Koch).

Calarca.

*Isomeria continua* (Pír.).

Region of Villa Vicencio.

BULIMULIDAE

*Plectostylus apolinari*, new species. Plate 6, figs. 1, 2.

Region of Villa Vicencio. Type and figured paratype 164566 A.N.S.P., collected by Vicente Guevara.

The oblong-conic shell is solid, umbilicate, deep livid brown, dappled with darker transverse or oblique spots on the last two whorls, and covered with a thin, yellowish periostracum which is largely lost in specimens seen; the earlier whorls are bicolored, light in the upper part, dark near the suture below; the apex whitish, obtuse. The whorls are rather weakly convex, the last rather more obliquely descending. The surface is glossy where the cuticle is preserved, elsewhere dull; weakly granulose on the last two turns, and irregularly marked with wrinkles of growth, which are a little stronger below the suture. The aperture occupies about 60 per cent of the length, is slightly oblique, dark slate-violet within. The reflected and recurved lip and columella are light pinkish cinnamon. Columella is broadly reflected over but does not close the umbilicus, and is strongly folded within.

Length 56 mm., diam. 30.8 mm., length aperture 33 mm.; 5 whorls. Type.

Length 54 mm., diam. 30.3 mm., length aperture 31 mm.

It is related to *P. corticosus* (Sowb.), but has a more broadly conic spire, larger aperture, and is openly umbilicate instead of narrowly perforate. *P. auriformis* (Da Costa)<sup>1</sup> is a larger species said to be 74 mm. long, with 5 whorls, differing by its umbilicus ("*vix umbilicata*"), and in several minor details. These three forms are evidently nearly allied.

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<sup>1</sup> *Strophocheilus* (*Eurytus*) *auriformis* Da Costa, Proc. Malac. Soc. Lond. vol. 6, p. 5, pl. 1, f. 1. 1904.

**Plectostylus virgatus**, new species. Plate 6, figs. 3, 4, 5.

Valle de Tensa, Colombia. Type and figured paratypes 164573 A.N.S.P., collected by Manuel Gonzalez.

The ovate-conic shell is thin, narrowly umbilicate, cinnamon-buff shading into brown behind the lip, marked with spots and interrupted oblique and zigzag stripes of brown; the upper whorls olive-brown or reddish brown. The whorls are rather strongly convex; suture impressed, in the last half turn descending obliquely and then ascending shortly to the lip. The surface has little luster and is covered with a minute, close, shallow granulation and weakly marked with wrinkles of growth. There is an appearance of rather widely-spaced spiral striation in the texture of the shell, conspicuous enough in a proper light, but scarcely affecting the surface. The aperture occupies about 60 per cent of the length; interior with a silvery gleam and showing the external markings. Peristome reflected and recurved, coral-pink. Columella triangularly dilated above, hardly folded. Parietal callus thin and transparent.

Length 40.5 mm., diam. 23.6 mm., aperture 25.5 mm.;  $4\frac{1}{2}$  whorls. Type.

Length 35 mm., diam. 20.4 mm., aperture 20.7 mm.;  $4\frac{2}{3}$  whorls. Fig. 4.

Length 36 mm., diam. 21 mm., aperture 22.8 mm.;  $4\frac{1}{3}$  whorls. Fig. 5.

This species appears closely related to *P. episcopalis* (Pfr.) a larger shell with vinaceous-brown peristome. *P. virgatus* has also some superficial resemblance to *P. tricolor* (Pfr.), but that Ecuadorian species differs by the narrow peristome and columella, and the suture does not ascend to the aperture as the Colombian species.

**Plectostylus pulicarius** (Rve.).

Fusagasugá (Vicente Guevara); La Goajira (Baltazar Guevara). This is a much plumper shell than *P. virgatus*.

**Plectostylus episcopalis** (Pfr.).

Cordillera de Bogotá (Vicente Guevara). This species stands near *P. virgatus*, but is somewhat more solid, larger, darker, the columellar fold stronger, and the aperture and lip of a vinaceous-brown color. The specimen sent is imperforate.

**Plectostylus delicatus**, new species. Plate 6, figs. 6, 7, 8, 8a.

Soacha, near Bogotá, Colombia. Type and paratypes 164577 A.N.S.P., collected by Vicente Guevara.

The ovate-conic shell is thin, imperforate, hazel, with a hydrophanous pattern of very irregular, white, somewhat zigzag streaks and spots on the last two whorls, the earlier whorls dark or reddish. The suture is bordered below by a dusky band. The whorls are rather weakly convex, the last turn of the suture descending obliquely. The surface is covered with a very fine, weak granulation, sometimes almost effaced; the early whorls smooth. The aperture is large, two-thirds the length of the shell, oblique, ovate, dark hazel within. Peristome white, very little thickened, smooth, very narrowly expanded. Columella broadly concave, at its insertion dilated over and closing the umbilicus. Parietal callus transparent, dusky around the axis.

Length	31 mm.,	diam.	17 mm.,	aperture	20.3 mm.;	4 $\frac{1}{2}$ whorls.	Type.
"	31 "	"	17.5 "	"	21.4 "	4 $\frac{1}{2}$ "	"
"	36 "	"	19 "	"	23.7 "	4 $\frac{1}{2}$ "	"
"	29.7 "	"	18 "	"	21 "	4 "	"

Sometimes the hydrophanous markings spread over most of the surface, as in fig. 7. This species resembles *P. veranyi* (Pfr.) somewhat, but it is quite distinct, having a straighter outer lip and a longer scarcely folded columella, much as in *P. succinoides* (Petit).

***Drymaeus cantatus medinanus***, new subspecies. Plate 6, fig. 13.

Region of Medina, on the eastern slope of the Cordillera, east of Bogotá. Type 164572 A.N.S.P., collected by Manuel Gonzalez.

The shell is umbilicate fusiform, nearly white, the apex buff, last half of the last whorl faintly flesh-tinted, the back of the expanded lip cartridge buff. The whorls are rather short, convex, joined by a well-impressed, slightly irregular suture. Apical 1 $\frac{3}{4}$  whorls have the usual *Drymaeus* sculpture; subsequent whorls with fine, irregular growth-wrinkles and some sparsely scattered malleation. The last whorl tapers downward and is somewhat compressed around the moderately wide but not deep umbilicus. The aperture is conspicuously narrowed anteriorly, livid pink inside, darkening to lilac within the lip. The peristome is white, well expanded, retracted at the narrow base. Columella slightly concave, with reflected edge. Parietal callus thin, pale lilac. Length 35.8 mm., diam. 17 mm., length aperture 18 mm.; 7 whorls.

This shell is very similar to the figure of *D. cantatus* (Rve.), but it lacks the small spots in four series, which ornament that shell. *D. cantatus* was not localized, but the Denison collection whence it was described, contained many Colombian snails. Lubomirski recorded it from Tarma, Peru, in his catalogue of the shells collected by Jelski. This place is so remote from Medina that no species of *Drymaeus* is likely to occur in both places. Pending the receipt of further information on the habitat of *D. cantatus*, I am naming the Medina form, although the difference in color pattern is in itself of little significance in this genus.

***Drymaeus tusagasuganus***, new species. Plate 6, fig. 14.

Tusagasugá, Colombia. Type 164570 A.N.S.P., collected by Vicente Guevara.

The shell is rather narrowly umbilicate, fusiform, ivory yellow, profusely streaked with chamois and cinnamon-buff, darker towards the base, and with more distinct stripes on the spire; the back of the expanded lip orange-cinnamon. There are also two spiral series of small dark spots and dashes on the last whorl. The buff apex shows *Drymaeus* sculpture. The whorls are weakly convex, the last tapering anteriorly and a little compressed at the base. Suture narrowly white-edged. The surface is glossy, with irregular growth wrinkles. The aperture is veronia purple within, lighter in the throat. The thin, well-expanded peristome is veronia purple, paler at the edge, retracted at the base. Columella reflected, and, with the thin parietal callus, colored like the lip. Length 29.7 mm., diam. 12.3 mm., length aperture 14.5 mm.; 7 whorls.

**Drymaeus felix** (Pfr.).

Region of Villa Vicencio, coll. by Vicente Guevara.

**Metorthalicus powisianus** (Petit).

Cali, in western Colombia, coll. by Hmo. Apolinar Maria.

**Metorthalicus atramentarius** (Pfr.).

San Gil, collected by Hmo. G. Victor.

**STREPTAXIDAE****Streptaxis anomphalus**, new species. Plate 6, figs. 11, 11a.

Region of Villa Vicencio. Type 164579 A.N.S.P., collected by Vicente Guevara.

The imperforate shell is somewhat trochiform, nearly symmetrical, the base of the last whorl a little flattened in front of the aperture; lateral outlines of the spire are convex. Color and texture as in *S. contusus*. The first  $3\frac{1}{2}$  whorls are smooth, the rest regularly rib-striate, the riblets about equal to the intervals, which are closely grooved and striate spirally. There are a few rather inconspicuous growth-rest lines in the type, two on the penult, two on the next earlier whorl. The base is smooth and glossy. The peristome is reflected and recurved, the outer margin retracted; dilated and appressed over the umbilicus. Height 20.5 mm., diam. 23.8 mm.;  $7\frac{3}{4}$  whorls.

A much smaller adult shell sent with the type measures, height 14.6 mm., diam. 18 mm.;  $6\frac{3}{4}$  whorls (Plate 6, fig. 12).

Compared with *S. dacostae* Gude<sup>2</sup> from Cauca, this form differs by the more convex outlines of the spire and the much wider aperture. *S. funcki* (Pfr.), reported from New Granada, is much more depressed and oblique in figure. The only other large *Streptaxis* recorded from Colombia is *S. subregularis* Pfr.,<sup>3</sup> at first described from an unlocalized shell, and later reported by Pfeiffer from Rio Janeiro and Bogotá. A. D. Brown (1869, Journ. de Conchyl. vol. 17, p. 124) reported *S. subregularis* from Tijuca (misprinted "Jijuco"), about 30 miles from Rio de Janeiro, but I believe that his specimens (No. 4420 A.N.S.P.) are not really that species. They have the very convexly conic spire of *S. contusus*, and were collected in company with it. I think that they are probably a form of *contusus*.

*S. anomphalus* differs from *S. subregularis* by being imperforate with the outlines of the spire more convex. I have not seen *subregularis*, but according to the figures it is openly umbilicate.

**Artemon colombianus**, new species. Plate 6, figs. 16, 17, 18.

Region of Villa Vicencio. Type and 2 paratypes figured are No. 164578 A.N.S.P., collected by Vicente Guevara.

<sup>2</sup> Proc. Malac. Soc. London, vol. 5, p. 322, pl. 12, f. 5-7.

<sup>3</sup> See Philippi, Abbild. u. Beschreib. neuer Conch., vol. 2, p. 127, *Helix* pl. 8, figs. 12. The figures published later in the Conchylien Cabinet appear to be copies of Philippi's.

The shell is umbilicate, the width of umbilicus contained  $5\frac{1}{4}$  to  $5\frac{1}{2}$  times in the diameter; corneous with a faintly olive-buff tint; depressed, with low conoid spire, very obtusely subangular periphery and convex base; composed of about 7 closely coiled, slowly increasing, convex whorls. The surface is smooth in the first 3 whorls, the rest regularly costulate-striate, the striae about equal to their intervals, which are irregularly indented and grooved spirally. The striae do not extend below the periphery, the base being smooth and glossy, showing faint growth-winkles only. There are usually 2 growth-rest ridges on the last whorl and inconspicuous ones on preceding whorls. The lunate aperture is rather strongly oblique. Peristome slightly thickened and narrowly reflected at outer and basal margins. Umbilicus somewhat well-like, contracting but slowly within.

Height 16.2 mm. diam. 24.8 mm.; 7 whorls.

Height 14.7 mm., diam. 23.6 mm.;  $6\frac{3}{4}$  whorls.

So far as I know, this is the first *Artemon* from Colombia. Usually the peristome expanded at the last growth-rest, or the last two, so that specimens with the lip finished will be found considerably smaller than the dimensions given above.

#### OLEACINIDAE

*Euglandina apolinari*, new species. Plate 6, fig. 15.

Eastern slope of the Cordillera de Bogotá. Type 164580 A.N.S.P.

The narrowly oblong shell is rather thin, of a brown hazel color, with a light band below the suture of the embryonic whorls, the apex white. The whorls increase regularly in width and are rather weakly convex, the last somewhat compressed. The outlines of the spire are noticeably convex. There are  $3\frac{1}{2}$  embryonic whorls, very weakly convex, nearly smooth, the apex obtuse. Subsequent whorls are irregularly weakly striate, the last two whorls shortly and finely plicate below the suture, which is not margined; under a strong lens fine, weak spiral lines are seen on the last two turns, becoming obsolete on the latter part of the last. The aperture is decidedly less than half of the total length, pinkish within, the thin, smooth lip having a whitish border. The columella is whitish, moderately concave. Length 46.7 mm., diam. 16.4 mm., length aperture 21 mm.;  $6\frac{3}{4}$  whorls.

It is related to *E. isabella* Pils.<sup>4</sup> from northwestern Colombia but it is much larger with the same number of whorls, the sculpture is weaker, and the suture is not margined. The apex, though obtuse, is not truncate, as it is in *E. isabella*.

*Euglandina bogotensis* (Da Costa). Plate 6, fig. 10.

One specimen from the region of Villa Vicencio (No. 164581 A.N.S.P.) is apparently not adult. It is narrower than Da Costa's type of *E. bogotensis*<sup>5</sup> and the lateral outlines of the spire are distinctly though weakly concave. Length 45 mm., diam. 17.4 mm.;  $6\frac{1}{2}$  whorls.

<sup>4</sup> Man. Conch. (2), vol. 19, p. 183.

<sup>5</sup> *Glandina bogotensis* Da Costa, Proc. Malac. Soc. Lond., vol. 6, p. 6, pl. 1, f. 5. 1904.

*Euglandina bogotensis* (Da C.), Pilsbry, Man. Conch. (2), vol. 19, p. 179, pl. 20, f. 9 (not f. 7).



## LYMNAEIDAE

*Lymnaea bogotensis*, new species. Plate 6, fig. 9.

Bogotá. Type 164556 A.N.S.P., collected by Hino. Apolinar Maria.

The shell is umbilicate, ovate, thin, light brown, with short, conic spire; glossy, with fine, irregular striae and wrinkles of growth, which, above the periphery, are cut into long granules by some indistinct spirals. The large aperture is oblique, ovate, broadly rounded below. Columella dilated above, passing in a very wide angle into the thickened parietal callus. There is a distinct, long fold, chiefly visible in an oblique view in the mouth. Length 13.7 mm., diam. 8.6 mm., length aperture 9.8 mm.

*Lymnaea selli* (Preston).

*Limnea selli* Preston 1907, Ann. Mag. N. H. (7), vol. 20, p. 496.

Usaqueu, Bogotá, collected by R. P. E. Rochereau. It was described from Bogotá.

## PLANORBIDAE

*Helisoma canonicum* (Cousin).

Bogotá. The specimens agree well with the account of this Ecuadorian species.

## AMPULLARIIDAE

*Pomacea producta* (Rve.).

Region of Villa Vicencio, collected by Vicente Guevara.

## MUTELIDAE

*Anodontites trautwiniana* (Lea).

Cali, in western Colombia.

## EXPLANATION OF PLATE 6.

Figs. 1, 2. *Plectostylus apolinari*, n. sp.

Figs. 3-5. *Plectostylus virgatus*, n. sp.

Figs. 6-8a. *Plectostylus delicatus*, n. sp.

Fig. 9. *Lymnaea bogotensis*, n. sp.

Fig. 10. *Euglandina bogotensis* (DaCosta), var.

Figs. 11, 11a, 12. *Streptaxis anomphalus*, n. sp.

Fig. 13. *Drymaeus cantatus medinanus*, n. subsp.

Fig. 14. *Drymaeus tusagasuganus*, n. sp.

Fig. 15. *Euglandina apolinari*, n. sp.

Figs. 15-18. *Artemon colombianus*, n. sp.

**ZOOLOGICAL RESULTS OF THE THIRD DE SCHAUENSEE SIAMESE  
EXPEDITION, PART VI. — FISHES OBTAINED IN 1934**

BY HENRY W. FOWLER.

Since the two papers on Siamese fishes published in these PROCEEDINGS in 1934 other extensive collections have been secured by Mr. Rodolphe Meyer de Schauensee for the Academy. These materials number 2394 specimens, represented by 298 species of which 25 are here described as new, besides a new subfamily. Many are marine or tidal, and were obtained at Bangkok in May, July and September, Paknam in August, and Sriracha in July. Fresh-water materials were obtained at Keng Sok, southwest Siam, in February; at Srisawat, in west central Siam, in July; at Khao Nam Poo, north central Siam, in October.

In comparison with the materials already reported it is interesting to note that comparatively few species have been duplicated, especially in the fresh-water forms. As several dates apply to the specimens taken at Bangkok, it is to be assumed all were obtained during May, unless otherwise mentioned.

The Academy is indebted to Mr. De Schauensee for this handsome gift to its museum, especially as so many of the species were not previously represented.

**ORECTOLOBIDAE**

**Hemiscyllium griseum** (Müller and Henle). Figure 1.

One, 300 mm., Bangkok. In these PROCEEDINGS vol. 85, 1933, p. 234, under Scyliorhinidae the subfamily name Galeinae should read Scyliorhininae, type genus *Scyliorhinus* Blainville 1816.

**GALEORHINIDAE**

**Scoliodon sarrakowah** (Cuvier). Figures 2 (lateral view) and 3 (head below).

One, 293 mm., Bangkok.

**Scoliodon walbeehmi** (Bleeker). Figures 4 (lateral view) and 5 (head below).

One, 323 mm., Bangkok.

**DASYATIDAE**

**Dasyatis imbricatus** (Schneider). Figure 6 (Bangkok).

Five, disk length 50 to 104 mm., disk width 45 to 90 mm. Entirely smooth. Sriracha, July 19 and 24.

One, disk length 84 mm., disk width 83 mm. Body smooth, except 2 small asperities on middle of disk above. Paknam, August 28.

One, 400 mm. total length, disk width 180 mm. Bangkok.

**Dasyatis kuhlii** (Müller and Henle).

One, 290 mm. long, disk width 154 mm., Bangkok. Garman places his *Dasybatus varidens* as a doubtful synonym of this species. I have examined the type in the U. S. National Museum and find it synonymous.

#### MYLIOBATIDAE

**Aetomyleus maculatus** (Gray). Figure 7.

One, disk length 120 mm., disk width 193 mm., tail 423 mm., Bangkok. The broad roof-like projection over the spiracle conspicuous. The coloration of this early stage of the specimen here figured not previously noticed.

The generic name has been changed to *Aetomyleus* by Sharp 1912. Wrongly spelled *Aetomylus* in my "Synopsis of the Fishes of China" 1930.

#### NOTOPTERIDAE

**Notopterus chitala** (Buchanan-Hamilton).

One, 274 mm. Tail with (5 on left, 6 on right side) large, black, pale edged ocelli posteriorly. Bangkok, May.

One, 49 mm., Paknam, August 28.

**Notopterus notopterus** (Pallas).

Three, 118 to 148 mm., Bangkok.

#### DUSSUMIERIIDAE

**Dussumieria acuta** Valenciennes.

One, 124 mm., Paknam; two, 110 to 145 mm., Bangkok. Depth  $4\frac{1}{2}$  to 5. Scales about 45.

#### DOROSOMIDAE

**Nematalosa nasus** (Bloch).

Six, 173 to 180 mm., Bangkok.

**Anodontostoma chacunda** (Buchanan-Hamilton).

One, 10 mm., Paknam, August 28; three, 56 to 99 mm., Sriracha, July 10 and 24, August 28; 49 examples, 52 to 88 mm., Bangkok.

#### CLUPEIDAE

**Hilsa kanagurta** (Bleeker). Figure 8.

Eleven, 163 to 185 mm., Bangkok, July 23.

**Kowala thoracata** Valenciennes. Figure 9 (Bangkok).

Six, 60 to 88 mm., Paknam; 17 examples, 44 to 98 mm., Bangkok.

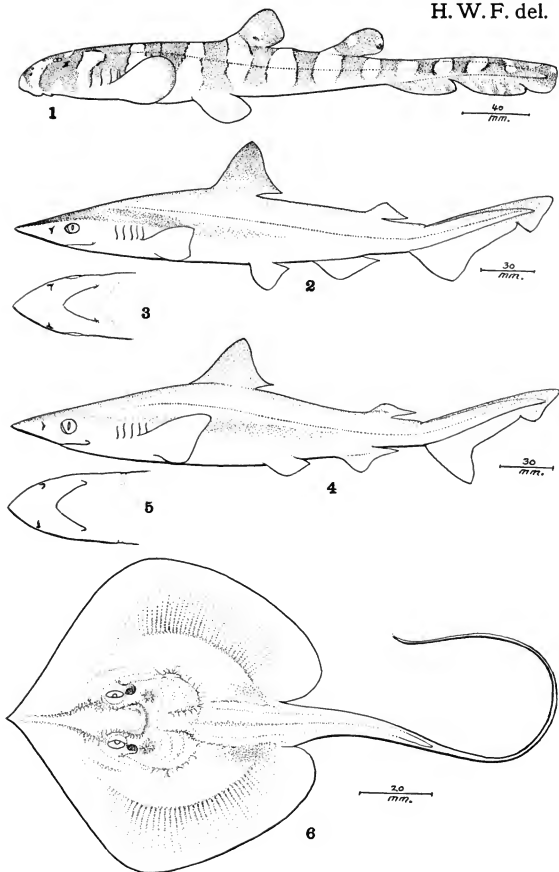
**Sardinella sirm** (Rüppell). Figure 10 (Bangkok).

Seven, 165 to 200 mm., Bangkok; one, 168 mm., Sriracha, July 10.

**Harengula brachysoma** (Bleeker).

Eight, 74 to 137 mm., Bangkok; one, 133 mm., Sriracha; one, 109 mm., Paknam, August 28. All show blackish blotch at dorsal origin.

H. W. F. del.



1. *Hemiscyllium griseum*.      2, 3. *Scoliodon sarrakowah*.  
 4, 5. *Scoliodon walbeekmi*.      6. *Dasyatis imbricatus*.

*Corica laciniata*, new species. Figure 11 (type).

Depth 4 to  $4\frac{1}{2}$ ; head  $3\frac{2}{3}$  to  $3\frac{3}{4}$ , width  $2\frac{1}{4}$  to  $2\frac{1}{2}$ . Snout  $3\frac{1}{2}$  to 4 in head from snout tip; eye 3 to  $3\frac{1}{2}$ , greater than snout or interorbital; maxillary reaches  $\frac{1}{3}$  to  $\frac{2}{3}$  in eye, expansion 2 in eye, length  $2\frac{1}{3}$  to  $2\frac{2}{3}$  in head from snout tip; apparently no teeth; interorbital 4 to  $5\frac{1}{2}$ , low, slightly convex. Gill rakers  $11 + 21$ ,  $1\frac{1}{2}$  in eye; gill filaments  $\frac{2}{3}$  of gill rakers.

Scales 30 or 31 in lateral series from shoulder to caudal base and 2 or 3 more on latter; 10 scales transversely at dorsal origin, 14 or 15 predorsal scales. Caudal base scaly. Scales with 12 to 14 well-contrasted, marginal, straight, basal striae, group above and below axis each with parallel striae so their angles would converge; basal circuli 35 to 38, obsolete apically. Abdominal scutes 10 or  $11 + 8$  or 9.

D. III, 11, 1, first branched ray  $1\frac{2}{3}$  to  $1\frac{3}{4}$  in total head length; A. III,  $11 + 2$  or III,  $12 + 2$ , first branched ray  $2\frac{2}{3}$  to  $2\frac{3}{4}$ ; caudal  $1\frac{1}{2}$  to 1, forked, lobes pointed; least depth of caudal peduncle  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; pectoral  $1\frac{1}{2}$  to  $1\frac{3}{4}$ , rays 1, 10; ventral rays 1, 7, fin  $1\frac{1}{2}$  to 2 in total head length.

Color pale to whitish, fading pale brown in alcohol. Back above with dark spots or dots. Iris whitish. Dorsal and caudal dusted with dark gray.

A.N.S.P., No. 61415. Bangkok, Siam. May 1934. Length 65 mm. Type. Also Nos. 61416 to 61457 and 60519 to 60551, same data. Length 46 to 53 mm. Paratypes.

Also 2 from Paknam, 52 to 58 mm.

A species related to *Corica soborna* (Buchanan-Hamilton), reported from the Bangpakong River by Dr. H. M. Smith in 1933. According to Day its scales are given as 40 to 42. Day also places *Spratella pseudopterus* Bleeker as doubtful synonym. It was described from Borneo and is admitted as a valid species, *Corica pseudopterus* by Weber and Beaufort, with scales 37 to 40. The chief distinction for *Corica laciniata* would therefore be larger scales, or 32 to 34 in a lateral series. Day's figure of *Corica soborna* shows the dorsal origin midway between the front edge of the eye and the caudal base and the anal fins not distinctly separated.

(*laciniata*, gashed, with reference to the divided anal fin.)

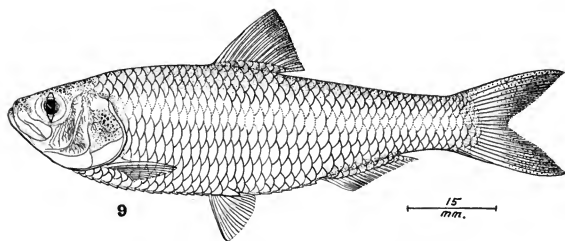
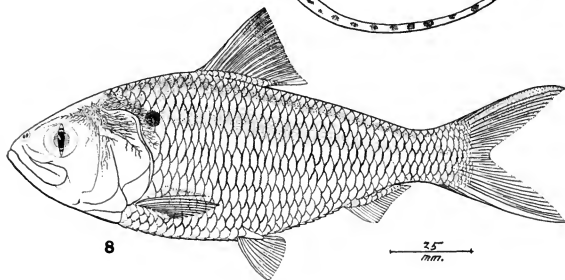
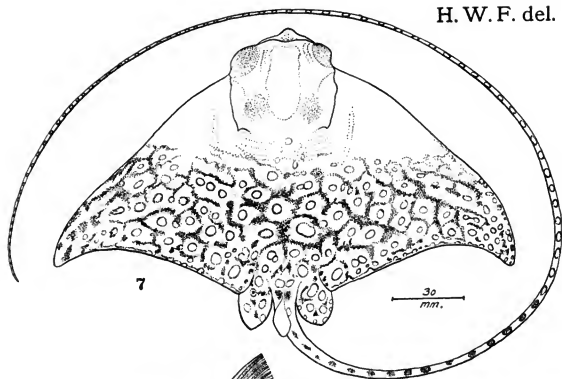
*Clupeoides exilis*, new species. Figure 12.

Depth 4 to  $4\frac{1}{2}$ ; head  $3\frac{1}{3}$  to  $3\frac{3}{4}$ , width  $2\frac{1}{4}$  to  $2\frac{1}{2}$ . Snout 4 to  $4\frac{1}{2}$  in head from snout tip; eye 3 to  $3\frac{1}{2}$ , greater than snout or interorbital; maxillary reaches  $\frac{1}{3}$  to  $\frac{1}{4}$  in eye, expansion  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in eye, length  $2\frac{1}{3}$  to  $2\frac{2}{3}$  in head from snout tip; teeth not evident; interorbital  $4\frac{1}{2}$  to  $4\frac{1}{2}$ , low, slightly convex. Gill rakers  $13 + 23$ , lanceolate,  $1\frac{2}{3}$  in eye; gill filaments  $\frac{2}{3}$  of gill rakers.

Scales 30 or 31 in lateral series from shoulder to caudal base and 2 or 3 more on latter; 10 scales transversely at dorsal origin; 13 or 14 predorsal scales. Caudal base scaly. Scales with 4 to 6 basal, marginal, slightly radiating striae; circuli 45 to 50 basally, not extended apically. Abdominal scutes 10 or  $11 + 9$  or 10.

D. III, 11, 1 or III, 12, 1, first branched ray  $1\frac{1}{2}$  to  $1\frac{1}{3}$  in total head length; A. III, 14, 1 to III, 16, 1, first branched ray  $1\frac{3}{4}$  to 2; caudal 1 to  $1\frac{1}{2}$ , deeply

H. W. F. del.



7. *Actomyxus maculatus*. 8. *Hilsa kanagurta*.  
9. *Kowala thoracata*.

forked, lobes sharp pointed; least depth of caudal peduncle  $2\frac{1}{2}$  to  $2\frac{1}{4}$ ; pectoral  $1\frac{1}{2}$  to  $1\frac{3}{5}$ , rays 1, 10; ventral rays 1, 7, fin  $1\frac{1}{2}$  to 2 in total head length.

Very pale brown to whitish generally. Back above with scattered dark gray dots, few also at end of snout and on cranium more distinct. Iris whitish, turning gray in alcohol. Fins pale or whitish, with gray on front edge of dorsal and upper and lower edges of caudal, also tip of each caudal lobe usually dark gray.

A.N.S.P., No. 60508. Bangkok, Siam. May 1934. Length 65 mm. Type. Also Nos. 60509 to 60518 and 61476 to 61488, same data. Length 46 to 58 mm. Paratypes.

This interesting fish has greatly the appearance of *Corica* Buchanan-Hamilton. I place it with *Clupeoides* Bleeker following Regan's distinctions in 1922, especially in its scale structure with a single transverse groove, the rest radiating. It differs from known species of *Clupeoides* in fewer scales, 32 to 34 compared with 35 to 42.

*Clupea huai* Tirant 1883, emended and called *Clupeoides hueensis* by Chevey 1932, is imperfectly noticed from Cochin China: Depth  $4\frac{1}{2}$  in body; head more than 5; no teeth in jaws or on tongue; lateral scales 31, transversely 14; abdominal serrae  $15 + 13$ ; D. III, 12; A. 17 or 18; silvery, with black spot on neck and another at pectoral base; length 100 mm. This nominal species, which may belong to *Kowala*, differs in a much smaller head, more numerous scales transversely, more abdominal serrae and different coloration.

Most of my examples of both *Corica laciniata* and *Clupeoides exilis* show traces of a faint lateral longitudinal band, more distinct on sides of caudal peduncle.

(*exilis* slim.)

***Ilisha brachysoma*** (Bleeker).

One, 122 mm., Bangkok; one, 138 mm., Paknam, August 28.

***Ilisha indica*** (Swainson). Figure 13.

Four, 223 to 228 mm., Bangkok.

***Opisthopterus indicus*** (Swainson).

One, 154 mm., Bangkok.

#### ENGRAULIDAE

***Thrissocles baelama*** (Forskål). Figure 14 (Bangkok).

Fourteen, 56 to 82 mm., Bangkok; three, 64 to 85 mm., Paknam; four, 63 to 67 mm., Sriracha, June 10.

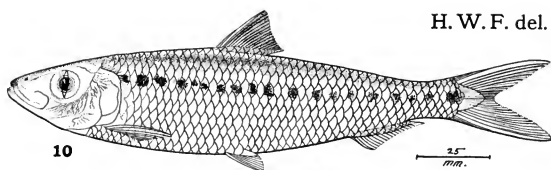
***Thrissocles mystax*** (Schneider).

Fifteen, 110 to 186 mm., Bangkok; one, 188 mm., Paknam.

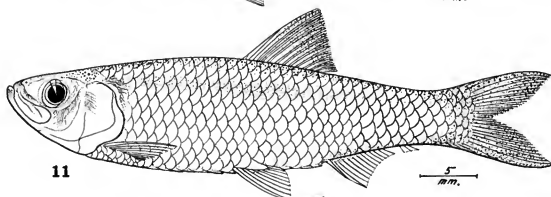
***Thrissocles hamiltonii*** (Gray).

One, 113 mm., Bangkok, A. II, 34, 1; one, 143 mm., Paknam, August 28, A. III, 36, 1.

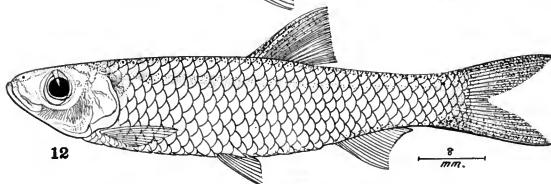
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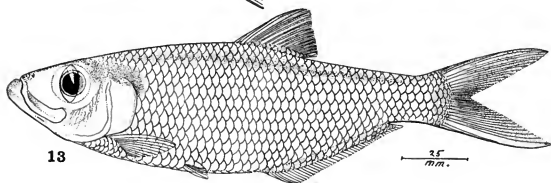
10

25  
mm.

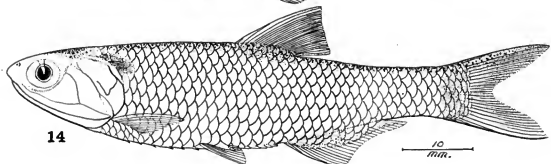
11

5  
mm.

12

8  
mm.

13

25  
mm.

14

10  
mm.

10. *Sardinella sirm.*      11. *Corica laciniata.*  
12. *Clupeoides exilis.*    13. *Ilisha indica.*  
14. *Thrissocles baelama.*



*Lycothrissa crocodilus* (Bleeker).

Nineteen, 69 to 230 mm., Bangkok.

*Setipinna taty* (Valenciennes).

Three, 48 to 168 mm., Paknam, August 28. A. III, 45, origin below front of dorsal base. Pectoral blackish subterminally and filament reaches first third in anal.

*Coilia macrognathos* Bleeker. Figure 15 (Bangkok).

Eight, 90 to 163 mm., Paknam, August 21 and 28; 25 examples, 44 to 170 mm., Bangkok, July 2 and 4. Agree largely with Weber and Beaufort's account in their free pectoral rays, anal fin rays and abdominal scutes. They differ a little in that the dorsal origin is mostly a little behind the ventral origin. Bleeker's figure shows the dorsal origin in advance of the ventral origin. The large, wide maxillary seems to be a character of distinction. Weber and Beaufort give "about 22 gill rakers" though my specimens show 30.

*Coila macrognathus aequidentata* Chabanaud from Saigon, on examples to 217 mm. is described with: D. 13; A. 75 to 80 (my specimens 70 to 72); abdominal serrae 36 to 38 (my specimens 32 to 35).

#### MONOPTERIDAE

*Macrotrema caligans* (Cantor).

One, 140 mm., Bangkok.

#### OPHICHTHYIDAE

*Pisodonophis boro* (Buchanan-Hamilton).

One, 422 mm., Bangkok.

#### PLOTOSIDAE

*Plotosus canius* Buchanan-Hamilton.

Three, 145 to 170 mm., Bangkok; four, 79 to 238 mm., Sriracha, June 10 and July 24.

#### SILURIDAE

*Belodontichthys dinema* (Bleeker).

One, 300 mm., Bangkok. A. 84.

*Ompok bimaculatus* (Bloch).

Two, 170 to 180 mm., Bangkok, September 24.

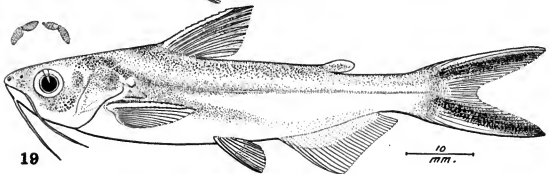
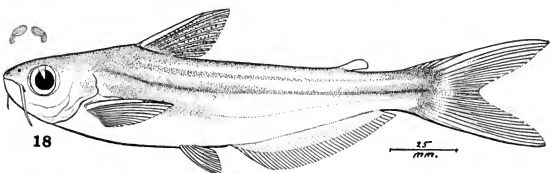
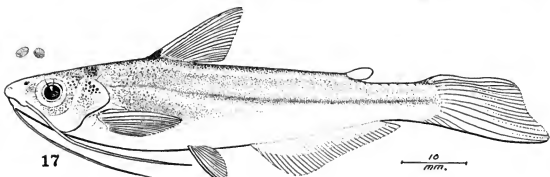
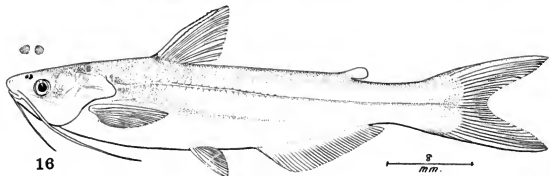
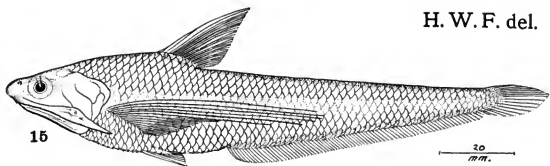
*Kryptopterus bicirrhys* (Valenciennes).

Six, 124 to 146 mm., Bangkok. Most have the rudimentary dorsal filament, evidently where absent due to damage of specimen.

*Kryptopterus apogon* (Bleeker).

One, 120 mm., Bangkok. More like Bleeker's figure of *Phalacronotus micropogon*, which does not show the mandibular barbel.

H. W. F. del.

15. *Coilia macrognathos*. 16. *Pangasius siamensis*.17. *Pangasius macronema*. 18. *Pangasius fowleri*.19. *Pangasius taeniura*.

**Kryptopterus hexapterus** (Bleeker).

One, 123 mm., Bangkok. Nasal barbel reaches  $\frac{1}{3}$  in pectoral and mandibular barbel 3 in head. No dorsal. A. II, 70.

**PANGASIIDAE**

**Pangasius siamensis** Steindachner. Figure 16, with vomerine teeth (upper insert).

Fifteen, 38 to 167 mm., Bangkok, May and July 2 to 4. Eye  $4\frac{1}{4}$  to  $5\frac{1}{2}$  in head; maxillary barbel reaches pectoral origin or end of fin; vomerine teeth in 2 large, rounded patches; A. II, 32 to 34. In the species of this genus and *Tachysurus* figured in this paper the small inserts above the head represent the vomerine teeth.

**Pangasius macronema** Bleeker. Figure 17 (caudal mutilated), with vomerine teeth (upper insert).

Two, 80 to 117 mm., Bangkok. Chevey 1930 has given a figure and description of a young example 56 mm. long doubtfully referred to this species. It differs strikingly in the ventral fin inserted slightly before the first dorsal.

**Pangasius fowleri** H. M. Smith. Figure 18, with vomerine teeth (upper insert).

One, 203 mm., Srisawat, July. A. IV, 38.

**Pangasius taeniura**, new species. Figure 19 (paratype), with vomerine teeth (upper insert).

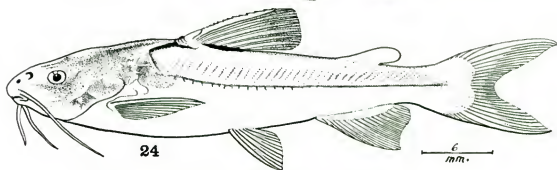
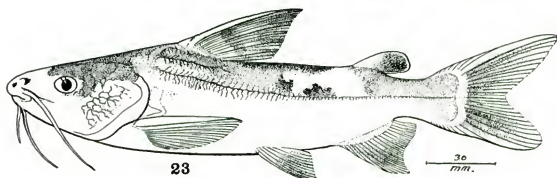
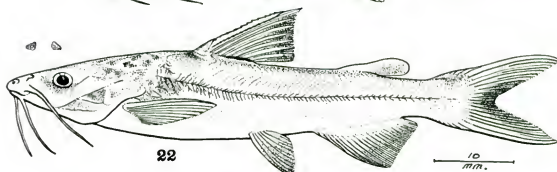
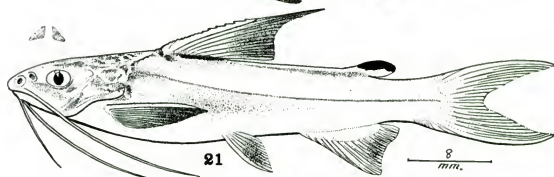
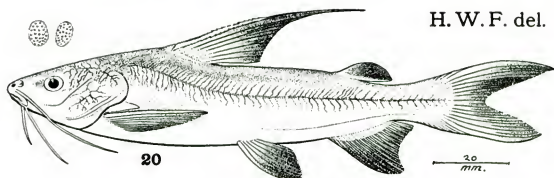
Depth  $4\frac{1}{4}$  to  $4\frac{3}{4}$ ; head  $3\frac{1}{2}$  to  $3\frac{3}{8}$ , width  $1\frac{1}{2}$  to  $1\frac{3}{8}$ . Snout 3 to 4 in head; eye 4 to  $4\frac{3}{4}$ , 1 to  $1\frac{3}{8}$  in snout,  $3\frac{1}{2}$  to  $3\frac{1}{4}$  in interorbital; mouth width  $2\frac{1}{8}$  to  $2\frac{3}{8}$  in head, gape nearly reaches eye; moderately narrow bands of minute villiform teeth in jaws and shorter arched band on vomer each side and parallel or only divided medially, also each section constricted a little medianly; maxillary barbel reaches slightly beyond pectoral origin, mental barbel reaches opercle; interorbital  $1\frac{1}{2}$  to  $1\frac{3}{8}$  in head, broadly convex. Gill rakers  $4 + 9$ , short, lanceolate,  $\frac{1}{2}$  of gill filaments, which  $\frac{1}{2}$  of eye.

Upper surface of head covered with thin skin, smooth. Occipital extension continuous with bony spine forward from spinous dorsal base. Humeral extension moderate,  $1\frac{1}{2}$  to twice eye diameter. Lateral line complete, axial along side of body and few short branches, chiefly below, on costal region.

D. I, 7, spine moderately robust, nearly straight, both edges with antrorse serrae and lower front edge with very small crowded spinules, first branched ray  $1\frac{1}{2}$  to  $1\frac{1}{4}$  in head; adipose fin  $2\frac{1}{2}$  to  $2\frac{1}{4}$ ; A. IV, 24, I or IV, 25, I, first branched ray  $1\frac{1}{2}$  to 2; least depth of caudal peduncle  $3\frac{1}{2}$  to  $3\frac{1}{4}$ ; pectoral  $1\frac{1}{2}$  to  $1\frac{1}{4}$ , spine with both edges serrate and 14 serrae along outer edge, rays 10 or 11; ventral I, 5, fin  $1\frac{1}{2}$  in head; caudal  $3\frac{1}{2}$  to  $3\frac{3}{8}$  in rest of fish, deeply forked.

Back and upper surfaces dark grayish, with lateral extension along front of lateral line and another along side of abdomen inclined little backward towards front of anal. Iris gray. Under surfaces of body, including barbels, whitish. Dorsal dark gray terminally, pale to whitish basally. Adipose fin grayish basally, whitish terminally. Caudal with dark gray longitudinal band in each lobe, otherwise whitish. Lower fins whitish.

H. W. F. del.



20. *Tachysurus maculatus*.      21. *Tachysurus caelatus*.  
 22. *Tachysurus melanochir*.    23. *Hemipimelodus bicolor*.  
 24. *Hemipimelodus borneensis*.

A.N.S.P., No. 61753. Bangkok, Siam. September 24, 1934. Length 85 mm. Type. Also No. 61754, same data, paratype. Length 83 mm.

Known by its coloration, especially the dark longitudinal band in each caudal lobe. Chevey 1930, figures and describes a small example 50 mm. long, which he doubtfully refers to *Pangasius pangasius* (Buchanan-Hamilton), differing in a greatly smaller eye little over 5 in the head and with different coloration. It thus follows that *P. pangasius* may be distinguished by its smaller eye, 4 to 6 according to Weber and Beaufort, and its caudal fin not contrasted.

(*ταυρία* band + *οὐρά* tail.)

### TACHYSURIDAE

**Tachysurus maculatus** (Thunberg). Figure 20 (young, Bangkok), with vomerine teeth (upper insert).

Two, 152 to 174 mm., Bangkok; one, 222 mm., Sriraja, June 10. Last with adipose fin brown like back.

**Tachysurus caelatus** (Valenciennes). Figure 21 (young, Bangkok), with vomerine teeth (upper insert).

Seven, 62 to 164 mm., Paknam, August 21; 81 examples, 48 to 179 mm., Bangkok, May and July. In small or young examples the first dorsal ray is elongate or well extended beyond the dorsal spine and may reach the middle of the adipose fin. These correspond to the *Pimelodus nenga* Buchanan-Hamilton, figured as *Arius nenga* by Day, who says it "is closely allied to *A. caelatus*, its maxillary barbel is longer, the dorsal spine more produced, and its colours different." His figure of "*Arius caelatus*" also has its posterior nostril midway in the snout, though in Bleeker's figures of *Arius arius* and *Arius pidada* the posterior nostril is well advanced or near the first third of the snout.

**Tachysurus melanochir** (Bleeker). Figure 22 (young), with vomerine teeth (upper insert).

Thirteen, 71 to 130 mm., Bangkok. All paler than Bleeker gives, or with but little dark pigment in fins.

**Ketengus typus** Bleeker.

Four in May, 114 to 168 mm., one in July, 118 mm., from Bangkok.

**Hemipimelodus bicolor**, new species. Figure 23.

Depth  $4\frac{1}{2}$ ; head  $3\frac{1}{2}$ , width  $1\frac{1}{2}$ . Snout 3 in head; eye  $6\frac{3}{4}$ ,  $2\frac{1}{2}$  in snout,  $3\frac{3}{8}$  in interorbital, eyelids free; mouth width  $2\frac{1}{2}$  in head; maxillary reaches half way to eye; teeth in villiform bands in jaws, irregularly 5 to 8 teeth transversely above and 3 or 4 transversely below; no teeth on palate or tongue; maxillary barbel not quite reaching pectoral origin, outer mental reaching  $\frac{2}{3}$  same space and inner mental but slightly over  $\frac{1}{3}$ ; interorbital  $2\frac{1}{10}$  in head, rather low and broadly convex; occipital fontanel broad, long, extends from little behind nostrils to front of occipital plate shortly before

hind edge of gill opening. Gill rakers  $5 + 13$ , rather short, blunt, strong,  $2\frac{1}{2}$  in gill filaments, which equal eye.

Cranium and occipital bridge rather coarsely rugose striate, latter continuous with dorsal plate. Humeral extension short, long as eye. Lateral line axial, distinct, with numerous short branches anteriorly.

D. I, 6, 1, spine with antrorse serrae along both edges, on front edge finer and more feeble basally, first branched ray  $1\frac{1}{2}$  in head; adipose fin  $2\frac{2}{3}$ ; A. iv, 14, 1, second branched ray  $2\frac{1}{10}$ ; upper caudal lobe  $1\frac{1}{6}$ ; least depth of caudal peduncle  $3\frac{1}{4}$ ; pectoral  $1\frac{1}{3}$ , both edges of spine with antrorse serrae of which about 32 on inner edge more distinct, branched rays 9; ventral  $2\frac{1}{10}$  in head, rays 1, 5.

Color, a large olive blotch on cranium extending back over to the pre-dorsal along and below dorsal irregularly until half way or more in post-dorsal region before adipose fin. Upper surface of tail below adipose fin and above lateral line, also same of caudal peduncle, olive. Rest of body white, with cream-colored tints on snout, cheeks, gill openings and most of fins basally. Iris gray. Barbels whitish. Dorsal grayish terminally, also obscure gray blotch medially and transversely. Adipose fin largely blackish terminally. Caudal with each lobe largely grayish medially. Lower fins with grays medially, little more dark on front of anal.

A.N.S.P., No. 60777. Bangkok, Siam. May 1934. Length 252 mm. Type.

Known by its greatly contrasted coloration. It approaches somewhat *Hemipimelodus velutinus* Weber, from New Guinea, in its adipose fin entirely above the anal, free edge of the eye, and number of gill rakers, but differs in shorter barbels and distinct axillary pore.

(*bicolor*, two colors.)

***Hemipimelodus borneensis*** (Bleeker). Figure 24 (young).

Six, 40 to 130 mm., Bangkok.

***Hemipimelodus cochlearis***, new species. Figure 25, with upper teeth (upper insert).

Depth  $5\frac{1}{2}$  to  $6\frac{1}{2}$ ; head  $3\frac{1}{2}$  to  $3\frac{2}{3}$ , width  $1\frac{3}{4}$  to  $1\frac{1}{4}$ . Snout 3 to  $3\frac{1}{2}$  in head; eye  $9\frac{1}{2}$  to  $10\frac{3}{4}$ ,  $3\frac{1}{4}$  to  $3\frac{1}{2}$  in snout, 4 to  $4\frac{1}{2}$  in interorbital, eyelids free; mouth width  $3\frac{3}{8}$  to  $3\frac{3}{4}$  in head; lips smooth, upper surface of snout above upper lip and chin behind lower lip rather coarsely papillose; maxillary barbel falls little short of pectoral origin, outer mental barbel  $\frac{3}{4}$  space to pectoral origin and inner mental barbel but little shorter; teeth in villiform bands in jaws, about 4 to 6 teeth irregularly and transversely; small patch of villiform teeth on each palatine, wide set; interorbital  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in head, broad, low, slightly convex. Gill rakers  $3 + 6$ , short points,  $\frac{1}{2}$  of gill filaments, which subequal with eye.

Cranium and top of head covered with thin skin, though former and complete occipital bridge to dorsal plate, with rather large rugosities. Occipital fontanel long, extends from front of interorbital to occipital extension or above middle of opercle. Humeral extension short, but little longer than eye. Lateral line axial, distinct, with many short branches both above and below most of its extent. Humeral pore distinct.

D. I, 7, spine long, slender, both edges antrorsely serrate, with 22 to 28 serrae along front edge and 17 or 18 along hind edge, first branched ray  $1\frac{1}{2}$  to  $1\frac{1}{4}$  in head, depressed fin reaching about  $1\frac{1}{4}$  to adipose fin; adipose fin length  $2\frac{3}{5}$  to  $2\frac{1}{5}$  in head; A. III or IV, 17 or 18, third or fourth ray  $1\frac{1}{2}$  to  $2\frac{1}{5}$ ; caudal  $1\frac{1}{4}$  to  $1\frac{1}{2}$ , well-forked, rather short lobes broad and pointed; least depth of caudal peduncle 4 to  $4\frac{3}{5}$ ; pectoral  $1\frac{2}{5}$  to  $1\frac{1}{2}$ , rays 9 or 10, both edges of spine antrorsely serrate of which 14 on inner edge; ventral rays 1, 5, fin 2 in head.

Back and upper surface grayish or drab, below whitish. Edges of snout pale or whitish all around. Barbels whitish. Iris grayish. Fins all pale or light, more or less grayish terminally. Adipose fin whitish, grayish basally.

A.N.S.P., No. 60767. Paknam, Siam. August 28. Length 205 mm. Type. Also Nos. 60768 to 60773, same data, except date August 21. Paratypes. Length 174 to 204 mm. One, 74 mm., Bangkok.

Related to *Hemipimelodus daugeti* Chevey 1932, based on an example 26 cm. long which differs in the absence of the axillary pore and palatine teeth. Its eyes are given as but 7 in the head,  $2\frac{3}{5}$  in snout (on plate) and 3 in the interorbital. According to the plate the barbels are much shorter and the depressed dorsal reaches  $1\frac{3}{5}$  to the adipose fin. The gill rakers (evidently lower?) are given as 7 and the anal rays 16 or 17.

(*cochleare*, spoon or scoop, with reference to the shape of the muzzle.)

**Batrachocephalus mino** (Buchanan-Hamilton).

One, 68 mm., Bangkok.

### BAGRIDAE

**Mystus nigriceps** (Valenciennes). Figure 26.

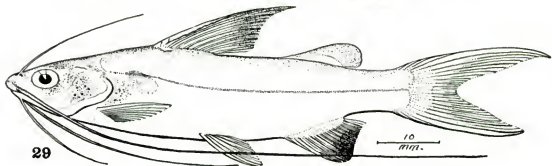
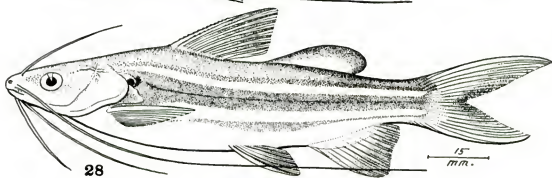
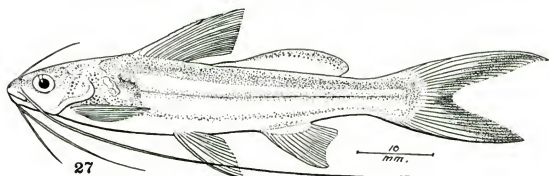
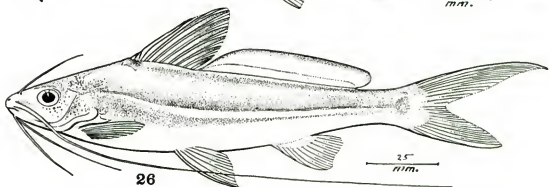
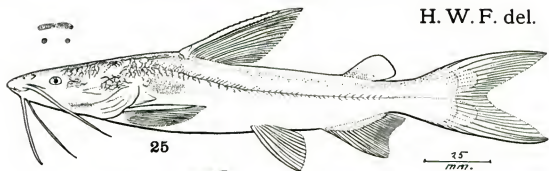
Three, 155 to 182 mm., Bangkok. All show the dorsal and adipose fins connected by a membrane and a pale or creamy streak along the lateral line for its greater part anteriorly, bounded above and below by a broad gray band, perhaps emphasized by formaline.

**Mystus rhegma**, new species. Figure 27.

Depth  $5\frac{1}{5}$ ; head  $4\frac{1}{2}$ , width  $1\frac{1}{4}$ . Snout  $3\frac{1}{4}$  in head; eye  $3\frac{1}{4}$ ,  $1\frac{1}{4}$  in snout, equals interorbital; mouth width 3 in head; lips broad, smooth; maxillary reaches  $\frac{2}{3}$  to eye; nasal barbel not quite reaching gill opening, maxillary barbel reaches slightly beyond caudal base, outer mental barbel reaches end of depressed pectoral, inner mental barbel reaches first fourth in depressed pectoral; bands of villiform teeth in each jaw and on vomer, latter similar, parallel, curved band like those in upper jaw; interorbital  $3\frac{1}{2}$  in head, rather low, convex. Gill rakers 5 + 14, finely lanceolate,  $1\frac{1}{2}$  in eye; gill filaments  $\frac{2}{3}$  of gill rakers.

Top of head covered with thin skin, occipital extension not forming complete bony bridge to dorsal plate. Occipital fontanel begins forward opposite nasal barbels and reaches base of occipital extension. Humeral extension little longer than eye. Lateral line axial, distinct, without branches.

H. W. F. del.



25. *Hemipimelodus cochlearis*.    26. *Mystus nigriceps*.  
27. *Mystus rhegma*.                28. *Mystus villatus*.  
29. *Mystus wolffii*.



D. I, 7, spine slender, straight, edges entire, first ray  $3\frac{1}{2}$  in fish without caudal; adipose fin length  $2\frac{1}{4}$ , height equals eye; A. III, 9, second branched ray  $1\frac{1}{4}$  in head; caudal  $2\frac{1}{4}$  in rest of fish, deeply forked, slender lobes pointed; least depth of caudal peduncle  $2\frac{3}{8}$  in head; pectoral 1, spine with front edge smooth and 10 recurved denticles, rather large, on inner edge, rays 10; ventral 1, 5, equals head.

Very light or pale brown, lower or under surfaces more or less whitish. Upper surface of head and back sprinkled with dark gray dots. Band of dark dots along lateral line and broader one along lower side of trunk and tail parallel. Iris grayish, also maxillary barbel, other barbels whitish. Outer edge of adipose fin dusted with dark gray dots. Caudal dark gray. Other fins pale or whitish.

A.N.S.P., No. 61748. Bangkok, Siam. September 24, 1934. Length 68 mm. Type.

Greatly like *Mystus nigriceps* but with three lateral longitudinal dark bands and with a distinct interdorsal notch, this about  $\frac{1}{4}$  of the length of the adipose fin.

( $\rho\eta\gamma\mu\alpha$  breach, with reference to the interdorsal notch.)

***Mystus vittatus*** (Bloch). Figure 28.

One, 121 mm. in May and nine, 115 to 158 mm. September 24, from Bangkok. These specimens without a pale line along the back, or another along the lateral line within the dark lateral median or axial band, as shown by Day.

***Mystus wolffii*** (Bleeker). Figure 29.

Five, 88 to 104 mm. in July and 33 examples, 74 to 148 mm. in May, from Bangkok. Bases of all fins rather bright yellow, dark gray to blackish gray terminally. Weber and Beaufort say "adipose fin about equal to anal and dorsal and to their distance," while Bleeker shows the adipose fin length  $2\frac{1}{3}$  dorsal fin length or  $1\frac{1}{4}$  in that of the anal or about  $1\frac{1}{3}$  in interdorsal.

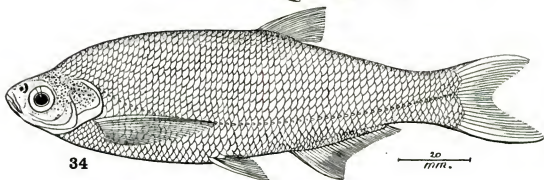
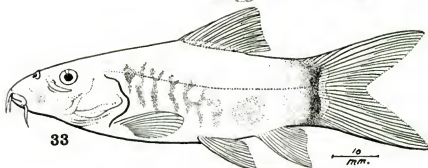
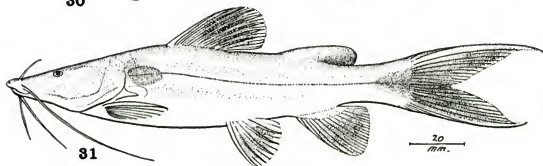
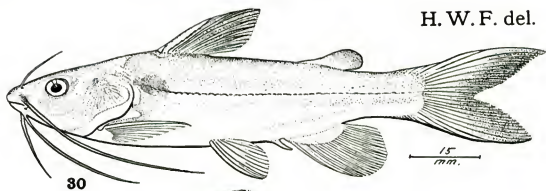
***Mystus planiceps*** (Valenciennes). Figure 30.

Five, 108 to 280 mm. in May and one 122 mm. September 24, from Bangkok. Known by its occipital extension only reaching half way or less to the dorsal plate, nasal barbels reaching eye diameter beyond eye, dorsal base half interdorsal length, adipose fin length  $1\frac{1}{4}$  to  $1\frac{3}{8}$  in depressed anal length, and ventrals inserted distinctly behind first dorsal base, so that ventral origin midway between pectoral origin and base of last anal ray to tip of same ray. Fin bases of pectoral, ventral, anal and lower rudimentary caudal rays orange-yellow.

***Mystus wyckii*** (Bleeker). Figure 31.

One, 190 mm., Bangkok. Differs slightly from Bleeker's figure in its narrow occipital fontanel reaching the base of the occipital extension, nasal

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30. *Mystus planiceps*. 31. *Mystus wychii*.32. *Nemacheilus myrmekia*. 33. *Botia modesta*.34. *Culter riveroi*.

barbels reaching eye, dorsal length greater than postorbital part of head, interdorsal  $\frac{3}{4}$  first dorsal fin base, pectoral spine little longer than dorsal spine.

*Prajadhipokia rex* Fowler 1934 is a synonym of the rare *Heterobagrus bocourti* Bleeker 1864, based on an example 235 mm. long. Bleeker's figure shows, as is the case with so many of his siluroids, the nearly impossible and drooping position of the pectoral fin.

#### COBITIDAE

*Acanthopsis choirorhynchus* (Bleeker). Figures 35 to 42 (color variation).

Series of 75 examples, 53 to 125 mm., Khao Nam Poo, October.

*Botia hymenophysa* (Bleeker).

One, 153 mm., Srisawat, July; four, 78 to 82 mm., Khao Nam Poo, October. Greatly like *Botia beauforti* but in addition to their spotted coloration also with dark transverse bands.

*Botia modesta* Bleeker. Figure 33 (variation).

One, 93 mm. in May and two, 81 to 103 mm., September 24, Bangkok.

*Nemacheilus maszyae* H. M. Smith.

One, 55 mm., Khao Nam Poo, October. No preorbital hook.

*Nemacheilus myrmekia*, new species. Figure 32.

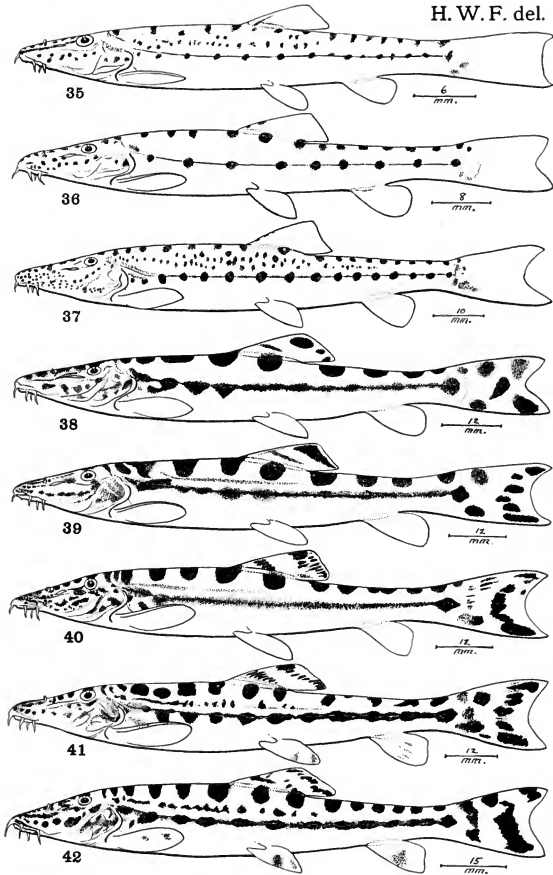
Depth 5; head  $3\frac{3}{4}$ , width  $1\frac{3}{4}$ . Snout  $2\frac{1}{2}$  in head; eye  $5\frac{1}{4}$ ,  $2\frac{1}{4}$  in snout,  $1\frac{1}{4}$  in interorbital; maxillary reaches half way in snout; mouth width  $3\frac{1}{2}$  in head; lower jaw shorter; lips entire; no nasal barbel; outer rostral barbel  $4\frac{3}{4}$  in head, inner little shorter, maxillary barbel  $3\frac{3}{4}$ ; interorbital  $1\frac{1}{4}$ , low, slightly convex. Front nostril with cutaneous margin, at last  $\frac{2}{3}$  in snout. Gill openings lateral, broad isthmus width  $2\frac{3}{4}$  in head.

Scales minute, about 77 along and close above lateral line to caudal base; 13 above lateral line, 12 below to ventral and 15 below to anal origin; entire predorsal region more or less naked, or only with few, minute, scattered scales; chest, breast and belly posteriorly nearly far as middle of depressed pectoral naked. Lateral line distinct, axial along side, complete, tubes simple. Small wart-like flap or spine close below front of eye.

D. I, 8, I, first branched ray  $1\frac{1}{2}$  in head; A. II, 5, I, first branched ray 2; caudal 1, emarginate, lobes rounded; least depth of caudal peduncle  $1\frac{1}{4}$ ; pectoral  $1\frac{1}{2}$ , rays I, 10; ventral rays I, 6, fin  $1\frac{1}{4}$  in head.

Brownish generally. Head with dark brown spots above, chiefly on cranium. On body 8 broad dark brown transverse bands, wider than pale interspaces; first above pectoral base; second wide, as result of 2 bands above fusing below, and occupies greater part of predorsal; third at front of dorsal to front of ventral; fourth from middle of dorsal; fifth from last dorsal ray; sixth behind dorsal and before anal; seventh to anal base; eighth behind anal base. Also darker transverse band at caudal base. Iris gray. Lips and barbels drab or brownish. Under surfaces of head and body but little paler than lighter shades of back. Dark transverse bands of sides not extending across abdomen or only last 3 on tail crossing. Fins

H. W. F. del.



35 to 42. *Acanthopsis choirorhynchus*.

grayish. Dorsal with dark spots on rays, anterior with 3, others with 2. Caudal with 2 transverse dark bands, besides blackish basal one. Anal with 2 transverse dark bands. Paired fins with 2 or 3 dark bands.

A.N.S.P., No. 63546. Keng Sok, Southwest Siam. February 3. Length 58 mm. Type.

In color pattern greatly resembles *Nemacheilus desmotes* Fowler, but differs in the different arrangement of the dark transverse bands. *N. desmotes* has 3 dark bands behind the dorsal and in the present species 4. It also differs in the presence of the preorbital hook.

(μυρμήκια wart, with reference to the preorbital hook.)

## CYPRINIDAE

### ABRAMIDINAE

**Culter riveroi**, new species. Figure 34.

Depth  $3\frac{1}{2}$ ; head  $4\frac{1}{2}$ , width  $2\frac{1}{2}$ . Snout  $4\frac{1}{2}$  in head from snout tip; eye  $3\frac{1}{2}$ , slightly greater than snout,  $1\frac{1}{2}$  in interorbital; maxillary reaches  $\frac{2}{3}$  to eye or below hind nostril, expansion 3 in eye, whole upper edge slips below preorbital, length  $3\frac{3}{4}$  in head from snout tip; lips thin, little developed, without barbels; hind nostril very large, more than twice front one; interorbital 3 in head from snout tip; suborbitals broad, cover cheek. Gill rakers  $12 + 30$ , finely lanceolate, equal gill filaments or  $\frac{1}{2}$  of eye. Pharyngeal teeth 2, 3, 4—5, 3, 2, slightly hooked, with rather broad, entire grinding surfaces.

Scales 53 in lateral line to caudal base and 2 more on latter; 12 above, 4 below to ventral origin, 6 below to anal origin, 42 predorsal forward to occiput opposite hind eye edge. Pectoral with axillary scale  $4\frac{3}{4}$  in fin; ventral with axillary scale  $3\frac{1}{2}$  in fin. Lateral line complete, strongly decurved above ventral base, tubes simple. Scales with 1 to 3 basal radiating striae and 3 to 6 apical; circuli fine, basal, obsolete apically.

D. II, 7, I, first branched ray (broken) about  $1\frac{1}{2}$  in total head length; A. III, 25, I, origin below last dorsal rays, first branched ray  $1\frac{1}{2}$ , with rather broad basal scaly sheath; caudal well forked, lower lobe little longer, about 4 in rest of fish; pectoral  $3\frac{1}{2}$ , rays I, 13; ventral rays I, 8, fin  $1\frac{1}{2}$  in total head length; least depth of caudal peduncle 2.

Back above and upper surface of head olive, sides and lower surfaces pale brownish, evidently silvery white in life. Iris whitish. Fins all pale, dorsal and caudal grayish marginally.

A. N. S. P., No. 60803. Bangkok, Siam. May 1934. Length 153 mm. Type.

This species appears to be related most nearly to my *Chela stigma-brachium*, differing in the absence of black on the outside of the pectoral, except some blackish dots on the uppermost or simple ray. It differs further in that the depressed pectoral extends a little beyond the base of the ventral, and the anal begins below the last dorsal rays. I was first inclined to identify it with *Paralaubuca typus* Bleeker 1865, but it is described with anal rays III, 29 or III, 30, the eye  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in head or equal to the interorbital, the types 112 to 120 mm. long.

(Named for Dr. Luis Howell Rivero, of Havana, Cuba, to whom I am indebted for collections of Cuban fishes.)

**Culter typus** (Bleeker).

One, 83 mm., Bangkok, September 21. Depth  $3\frac{1}{2}$ ; head 4; eye  $2\frac{1}{2}$  in head. Scales 18 (overlap 8) + 38 + 4 in lateral line; 14 above, 3 below to ventral origin, 6 below to anal origin. A. III, 27, 1. Middle of upper pectoral rays with dark and gray dots.

The above agrees in all essentials with the two Bangkok specimens I reported in 1934, especially with its anal origin below or behind the base of the last dorsal ray, the chief character of distinction for *Paralaubuca* as employed by Bleeker. The larger of my specimens with gill rakers 7 + 30. Bleeker also notes the pectoral especially with blackish dots. For these reasons *Paralaubuca* may be placed with *Culter*, perhaps as a subgenus.

**Culter siamensis** Hora.

Four, 143 to 220 mm., Bangkok. Upper profile of head convexly curved. Eye  $4\frac{1}{2}$  to 5 in head. Maxillary extends below level of eye. Lower gill rakers 26. Scales 64 + 5 in lateral line, sometimes right side interrupted as 25 (11 overlap) + 47 + 5. Predorsal scales extend forward nearly opposite hind eye edge. Below lateral line 5 scales to origin of ventral fin. A. III, 23, 1 or III, 24, 1. Pectoral reaches ventral in young, falls 3 or 4 scales short with age. Pectoral grayish above, little darker or more distinct on inner side of fin.

I do not think the figure of *Paralaubuca typus* of Hora 1923, based on 3 examples 58.6 to 69 mm. (without caudal) from Bangkok and Montaburi, is Bleeker's species of that name. Bleeker's description gives the scales as 20 transversely at base of ventral fin, of which 12 to 14 above the lateral line, which would suggest 5 to 7 below. Hora's figure shows 2 or  $2\frac{1}{2}$  scales below lateral line to ventral fin origin. This is like my *Chela barroni* of 1934. His figure also shows 59 or 60 in a lateral count, compared with 46 for *C. barroni*. In many other ways it is greatly similar.

To the present time I have accepted *Chela* Buchanan-Hamilton 1822 for the species of the present genus, following most European authors. As Bleeker 1862 formally designated *Cyprinus (Chela) cachia* Buchanan-Hamilton as genotype, *Chela* will supersede *Perilampus* McClelland 1839 as used by Day. *Oxygaster* Van Hasselt 1823 (type *Oxygaster anomalurus* Van Hasselt 1823 = *Cyprinus oxygaster* Valenciennes 1844) is the name now applicable to the group called *Chela* by Günther and Day, distinguished by the predorsal scales extending forward above the front or middle of the eye. *Culter* Basilewsky 1855, with *Culter alburnus* Basilewsky as the designated genotype of Bleeker 1862, includes species with the predorsal scales beginning behind the eyes. The Siamese species may then stand as: *Culter pointoni* (Fowler), *C. barroni* (Fowler), and *C. stigmabrachium*

(Fowler), besides those listed above. *Chela maculicauda* H. M. Smith 1934 I am unable to place generically. Bleeker spells *Macrochirichthys* 1859, not as I use *Macrocheirichthys* in 1934.

**Oxygaster oxygastroides** (Bleeker). Figure 43.

Nineteen, 84 to 108 mm., Bangkok. Depth  $3\frac{1}{4}$  to  $3\frac{3}{5}$ . Scales  $35 + 3$  in lateral line. A. III, 23, 1 to III, 29, 1. All with under surface of tail quite yellowish.

**Oxygaster siamensis** (Günther). Figure 44.

Depth  $2\frac{3}{4}$ ; head  $3\frac{3}{5}$ , width  $2\frac{1}{5}$ . Snout  $4\frac{1}{2}$  in head from snout tip; eye  $3\frac{2}{5}$ , greater than snout, equals interorbital; maxillary reaches front eye edge, expansion  $\frac{1}{3}$  of eye, length  $3\frac{1}{5}$  in head from snout tip; lips thin, narrow; mandibular symphysis with knob fitting in corresponding notch in front of upper jaw; interorbital  $3\frac{2}{5}$ , convexly elevated; suborbitals rather narrow, cover about  $\frac{3}{4}$  of cheek. Gill rakers  $3 + 9$ , short points,  $\frac{1}{3}$  of gill filaments, which  $\frac{1}{2}$  of eye. Pharyngeal teeth 2, 3, 5—4, 4, 2, small, but slightly hooked, each of larger with entire, moderate, grinding surfaces.

Scales 32 in lateral line to caudal base and 3 more on latter; 8 above, 3 below to ventral origin, 4 below to anal origin, 32 predorsal forward opposite front edge of eye. Caudal base scaly. Rather narrow scaly basal sheath on anal. Scales with 6 or 7 apical radiating striae; circuli fine, mostly basal, less numerous apically.

D. III, 7, 1, first branched ray  $\frac{4}{5}$  in total head length; A. III, 25, 1, first branched ray  $1\frac{1}{5}$ ; caudal  $3\frac{3}{5}$  in rest of fish, well forked, lower lobe longer; least depth of caudal peduncle  $2\frac{2}{5}$ ; ventral 2, rays 1, 6; pectoral rays 1, 10, fin 3 in fish without caudal, nearly reaches middle of depressed ventral.

Pale brownish, sides and below apparently whitish in life. Sides of head with silvery white. Iris grayish. Gray longitudinal axial streaks along tail to caudal base. Snout brownish above. Fins all pale, only few gray dots on inside of pectoral rays basally.

One, 83 mm., Bangkok. Agrees largely with Günther's account of *Chela siamensis*, especially the coloration noted as uniform silvery. Several items would differ slightly as A. 30, scales in lateral line 43, depth 3, head  $4\frac{1}{2}$ . *Chela siamensis* as described by Tirant 1929, differs in "Pectoral jaune pigmentée de noir et portant une large tache noire."

#### RASBORINAE

**Rasbora iateristriata** (Bleeker).

Sixty, 44 to 118 mm., Bangkok, May; also ten, 51 to 98 mm., July; one, 62 mm., September 24.

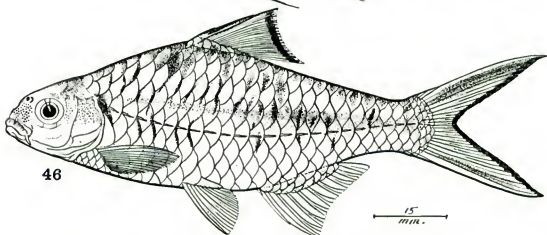
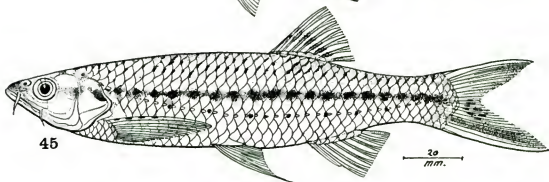
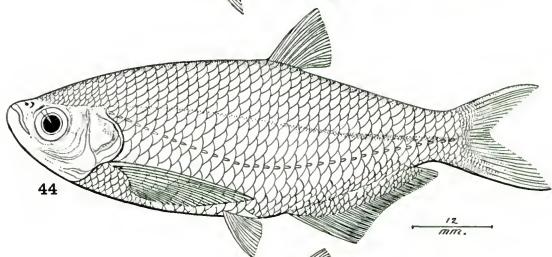
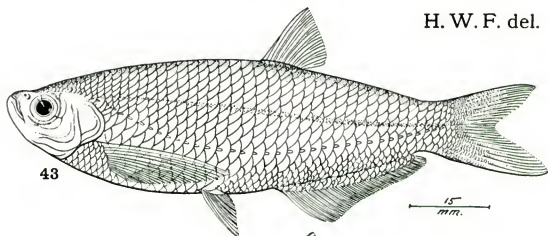
**Esomus danrica** (Buchanan-Hamilton).

Fifty-seven, 62 to 80 mm., Bangkok; two, 68 to 76 mm., Sriracha, July 10.

**Luciosoma harmandi** Sauvage. Figure 45.

Two, 154 to 178 mm., Bangkok.

H. W. F. del.

43. *Oxyaster oxygastroides*.44. *Oxygaster siamensis*.45. *Luciosoma harmandi*.46. *Mystacoleucus chilopterus*.



## CYPRININAE

**Leptobarbus hoevenii** (Bleeker).

One, 190 mm., Bangkok. Depth  $3\frac{1}{2}$ ; head  $3\frac{3}{8}$ . Eye  $4\frac{2}{3}$  in head; 4 barbels. Scales  $33 + 3$  in lateral line; 3 below to ventral or anal. D. III, 7, 1; A. III, 5, 1.

**Albulichthys albuloides** (Bleeker).

One, 283 mm., Bangkok. Differs a little from Bleeker's figure in that the tip of the closed mandible about level with the lower edge of pupil. Bleeker shows the end or tip of the snout slightly below the level of the eye.

*Albulichthys kremphi* Pellegrin and Chevey 1927, from Cambodia, is based on a specimen but 170 mm. long, said to differ in its larger eye  $3\frac{1}{2}$  in the head (4 in my specimen), more truncate snout, dorsal less elevated and last simple ray less serrated, also caudal peduncle more slender. Chevey 1930 thinks it probably the young of *A. albuloides*.

**Mystacoleucus chilopterus**, new species. Figure 46.

Depth  $2\frac{3}{4}$  to 3; head  $3\frac{3}{4}$  to 4, width  $1\frac{3}{4}$  to  $1\frac{1}{2}$ . Snout  $3\frac{1}{2}$  to  $3\frac{3}{4}$  in head; eye 3 to  $3\frac{1}{4}$ , greater than to subequal with snout, equals interorbital; maxillary reaches  $\frac{2}{3}$  to or to eye, expansion  $2\frac{3}{4}$  in eye, length  $3\frac{1}{4}$  to  $3\frac{3}{4}$  in head; lips rather narrow, fleshy; 4 barbels, rostral  $\frac{1}{2}$  of maxillary barbel, which 2 in eye; interorbital  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in head, convex; suborbitals narrow, about  $\frac{1}{3}$  of cheek to preopercular ridge. Gill rakers  $4 + 10$ , short points,  $\frac{1}{3}$  of gill filaments, which half of eye. Pharyngeal teeth 2, 3, 4—4, 3, 2, rather large in outer row, hooked, and most with broad, entire grinding surfaces.

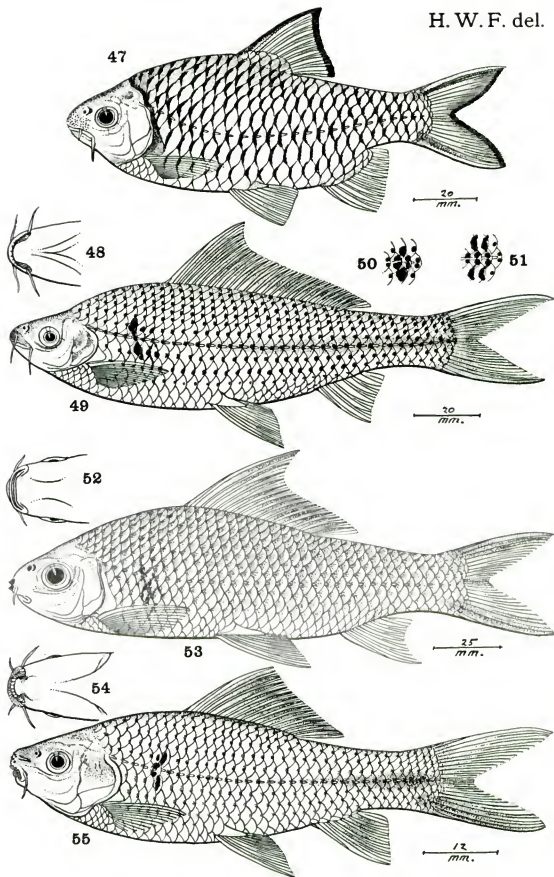
Scales 22 to 24 in lateral line to caudal base and 2 or 3 more on latter; 5 above, 3 below to ventral or anal origin, 6 or 7 predorsal. Snout end and around below nostrils studded with small close-set pearl organs, about 5 or 6 in transverse or vertical series. Anal base with scaly sheath. Caudal base scaly. Lateral line complete, little decurved from axis of body, tubes slender, rather long and simple. Scales with 2 to 5 short radiating basal striae and 16 or 17 longer apical; circuli moderate, mostly basal.

D. III, 8, 1, third ray rather thin, firmly pungent and with about 13 to 15 rather feeble serrae along hind edge, front edge entire, first branched ray  $1\frac{1}{2}$  to  $1\frac{1}{10}$  in head; A. III, 8, 1, third simple ray firm, pungent, entire,  $1\frac{1}{4}$  to  $1\frac{1}{2}$ ; caudal  $2\frac{3}{4}$  to  $2\frac{3}{8}$  in rest of fish, widely forked, lobes rather slender and sharply pointed; least depth of caudal peduncle 2 to  $2\frac{1}{4}$  in head; pectoral  $1\frac{1}{2}$  to  $1\frac{1}{3}$ , rays 1, 14; ventral rays 1, 8, fin  $1\frac{1}{2}$  to  $1\frac{3}{8}$  in head.

Back and upper surfaces dull or pale olive, mostly as median area on each scale. Sides from axial line below and under surface pale or light brown or drab, evidently whitish in life. Along middle of sides are scattered dark basal crescents to some few scales, irregular and contrasted. Iris gray. Fins pale, front and upper edges of dorsal and hind caudal edge narrowly blackish. Upper and lower edges of caudal with dark submarginal streak whole extent of each lobe. Anal and paired fins whitish.

A. N. S. P., No. 61785. Srisawat, Siam. July 1934. Length 104 mm. Type.

H. W. F. del.



47. *Mystacoleucus marginatus*. 48 to 51. *Dangila siamensis*.  
 52, 53. *Osteochilus spilopleura*. 54, 55. *Osteochilus lini*.

A. N. S. P., Nos. 61786 and 61787, same data. Length 95 to 103 mm. Paratypes.

Differs from the following species in coloration, much shorter maxillary barbels, concave edge of the anal fin, 3 scales below the lateral line to ventral origin, upper and lower caudal lobes with a submarginal dark gray to blackish streak, axillary ventral scale over half ventral fin, large eye and scales only with scattered dark or blackish basal-ares, not forming an even reticulated pattern. The procumbent predorsal spine is concealed.

( $\chi\epsilon\lambda\omicron\varsigma$  edge or rim +  $\pi\tau\epsilon\rho\acute{o}\nu$  fin; with reference to the dark borders of the dorsal and caudal.)

**Mystacoleucus marginatus** (Valenciennes). Figure 47.

Twelve, 70 to 142 mm., Srisawat, July; five, 95 to 115 mm., Khao Nam Poo, October. Bleeker's figure of *Puntius* (*Barbodes*) *obtusirostris* shows short maxillary barbels  $\frac{1}{2}$  of eye, anal edge convex, a strong robust serrated spine, upper and lower caudal edges pale like most of fin, axillary ventral scale little less than half of fin, eye  $3\frac{1}{4}$  (3 to  $3\frac{1}{2}$  in description) and pectoral reaching  $1\frac{2}{3}$  to ventral. The above specimens have a maxillary barbel long as the eye, serrated dorsal spine with its whole front edge blackish, upper and lower caudal edges grayish, axillary ventral scale  $\frac{2}{3}$  of the fin, eye  $3\frac{2}{3}$  to  $3\frac{3}{4}$  in head and pectoral reaching to one scale of ventral fin. The procumbent dorsal spine, before the dorsal fin, distinct though not free. In my largest example about 210 mm. long (caudal broken), from Ban Thung Luang, the maxillary barbel is half the eye and the axillary ventral scale nearly as long as the ventral fin.

**Dangila siamensis** Sauvage. Figures 48 (head below), 49 (lateral view of Khao Nam Poo specimen), 50 and 51 (variants of scapular blotch in Chieng Mai specimens).

Depth  $3\frac{1}{4}$  to  $3\frac{3}{4}$ ; head  $4\frac{1}{4}$  to  $4\frac{3}{4}$ , width  $1\frac{1}{2}$  to  $1\frac{3}{4}$ . Snout 3 to  $3\frac{1}{2}$  in head; eye  $3\frac{1}{2}$  to  $4\frac{1}{2}$ ,  $1\frac{1}{2}$  to  $1\frac{2}{3}$  in snout,  $1\frac{2}{3}$  to 2 in interorbital; maxillary reaches  $\frac{2}{3}$  to  $\frac{3}{4}$  in snout, length 3 to  $4\frac{1}{4}$  in head; barbels long, front one  $1\frac{1}{2}$  in snout, hind one long as snout; upper lip with 5 papillae; lower lip with lateral plications, width of broad entire section  $1\frac{2}{3}$  in eye; interorbital  $1\frac{1}{2}$  to  $2\frac{1}{2}$  in head, moderately high, broadly convex; suborbitals cover about  $\frac{1}{3}$  of cheek to preopercular ridge. Gill rakers 5 + 27, short points,  $\frac{1}{3}$  of gill filaments, which  $1\frac{2}{3}$  in eye. Pharyngeal teeth 2, 3, 5—4, 3, 2, small, little hooked, with moderate, entire, grinding surfaces.

Scales 33 to 36 in lateral line to caudal base and 3 more on latter; 7 above, 4 below to ventral, 5 below to anal origin, 10 or 11 predorsal. Caudal base scaly. Ventral axillary scale  $2\frac{1}{2}$  in fin. Lateral line complete, axial, tubes simple, moderate. Scales with 17 to 22 apical radiating striae; circuli fine, mostly basal, mostly obsolete apically.

D. III, 24, 1, first branched ray  $4\frac{1}{2}$  to  $4\frac{1}{2}$  in fish without caudal; A. III, 5, 1, first branched ray  $1\frac{1}{2}$  to  $1\frac{2}{3}$ ; caudal with upper lobe little longer,  $2\frac{3}{4}$  to  $3\frac{1}{4}$  in rest of fish, lobes slender and sharply pointed; least depth of caudal peduncle  $1\frac{1}{2}$  to  $2\frac{1}{4}$  in head; pectoral 1 to  $1\frac{1}{2}$ , rays 1, 14; ventral rays 1, 8, fin 1 to  $1\frac{1}{2}$  in head.

Back and upper surfaces olive, sides and lower surfaces paler to whitish. Each scale on sides with rounded, contrasted, blackish spot basally showing through preceding overlapping scale. Along lateral line on tail dark to blackish axial streaks, more distinct or conspicuous at caudal base. No distinct or defined black spot, however, at caudal base. At fifth scale of lateral line large black blotch on both scale above and scale below. Dorsal with membranes largely grayish terminally. Caudal grayish. Lower fins whitish.

Three, 78 to 163 mm., Khao Nam Poo, October. I have also compared the other materials reported in 1934. These show, even some of the small specimens, 2 rows of pearl organs on the front surface of the snout with 3 to 7 or more in each row, the median ones larger.

The original account of Sauvage, based on Bleeker's MS. name in the Paris Museum, is imperfect and unsatisfactory. It makes no mention of the peculiar dark blotch on the lateral line above the pectoral, which is quite conspicuous and very variable. The dark caudal spot is also equally distinct or absent. *Dangila spilopleura* H. M. Smith 1934 is apparently synonymous, though its scales are given as 44. Smith does not describe the lips and Sauvage says "lèvre supérieure non frangée." Some Chiang Mai specimens show the eye slightly longer than the snout.

***Dangila leptocheilus* (Van Hasselt).**

Depth  $3\frac{1}{3}$  to  $3\frac{3}{5}$ ; head  $4\frac{1}{2}$  to  $4\frac{4}{5}$ . Snout  $3\frac{3}{4}$  to  $3\frac{1}{2}$  in head; eye  $3\frac{2}{5}$  to  $4\frac{1}{5}$ , 1 to  $1\frac{1}{2}$  in snout,  $1\frac{3}{4}$  to 2 in interorbital; maxillary reaches  $\frac{2}{3}$  to  $\frac{3}{4}$  in eye, length  $4\frac{1}{5}$  to  $4\frac{2}{5}$  in head; interorbital  $1\frac{1}{8}$  to  $2\frac{1}{5}$ , broadly convex. Upper lip with 8 rather large papillae; rostral barbel long as eye, half long as maxillary barbel; suborbitals narrow, on  $\frac{1}{3}$  of cheek to preopercular ridge. Gill rakers 7 + 35, short weak close-set points,  $3\frac{1}{2}$  in gill filaments, which nearly equal eye. Scales 37 or 38 + 2 in lateral line; 8 above, 6 below to ventral [figure transposed wrongly as 9 in my 1934 paper], 6 below to anal, 10 or 11 predorsal. D. III, 24, 1 or III, 25, 1; A. III, 5, 1. Back and above olive, sides and below whitish. Iris gray. Barbels whitish. Dorsal membranes and caudal gray other fins whitish. Three 140 to 182 mm., Bangkok.

***Osteochilus hasseltii* (Valenciennes).**

Four, 119 to 173 mm., Bangkok.

***Osteochilus melanopleurus* (Bleeker).**

Four, 122 to 174 mm., Bangkok. Scales 50 + 4 in lateral line; 8 below to ventral. D. III, 17, 1.

***Osteochilus spilopleura*, new species. Figures 52 (head below) and 53.**

Depth  $3\frac{1}{5}$ , head  $4\frac{1}{2}$  width  $1\frac{1}{2}$ . Snout  $3\frac{1}{8}$  in head; eye  $3\frac{1}{4}$ ,  $1\frac{1}{10}$  in snout,  $1\frac{1}{5}$  in interorbital; maxillary reaches  $\frac{2}{3}$  in snout, length  $3\frac{2}{5}$  in head; lips entire, thin; only a single pair of barbels, rostral,  $1\frac{3}{8}$  in eye; edges of jaws firmly cartilaginous, trenchant; 2 series of rather large, close set pearl organs, 5 in upper and 4 in lower, not extending laterally beyond rostral barbel; nostrils together, separated by cutaneous flap; interorbital 2 in head,

moderately high, broadly convex; suborbitals narrow, cover  $\frac{1}{3}$  of cheek to ridge of preopercle. Gill rakers  $10 + 44$ , short, low, crowded, weak points,  $\frac{1}{2}$  of gill filaments, which  $1\frac{1}{2}$  in eye. Pharyngeal teeth 2, 3, 5—5, 3, 2, cuneiform, compressed, most all with broad, oblique, entire grinding surfaces.

Scales 31 in lateral line to caudal base and 4 more on latter; 8 above, 6 below to ventral or anal, 12 predorsal. Ventral axillary scale  $2\frac{1}{2}$  in fin. Caudal base scaly. Scales on breast small. Lateral line complete, axial, with short simple tubes. Scales with 25 to 27 radiating apical striae; circuli fine, mostly basal and more or less obsolete apically.

D. III, 15, 1, third simple ray  $3\frac{2}{3}$  in fish without caudal, reaches  $1\frac{2}{3}$  in fin; A. III, 5, 1, third simple ray 1 in head; least depth of caudal peduncle  $1\frac{3}{4}$ ; pectoral 1, rays 1, 15; ventral rays 1, 8, fin  $4\frac{1}{2}$  in fish without caudal.

Back olive, sides and below paler, evidently whitish in life. Back and sides with dark spot at base of each scale. At fifth and sixth scales of lateral line, one scale above and 3 or 4 below base of each with dark or blackish crescent. Iris grayish. Barbels pale. Dorsal and caudal grayish, rays of former paler and upper and lower edges of caudal rather dark grayish. Other fins pale to whitish.

A.N.S.P., No. 60808. Srisawat, Siam. July 1934. Length 213 mm. Type.

Only known from the type. Apparently close to *Rohita sima* Sauvage in proportions, scale and fin formulas, but that species described with its lower lips fringed and with uniform coloration. The very conspicuous dark or blackish bar across the lateral line from the fourth to sixth scales of the lateral line not mentioned by Sauvage.

(σπίλος blot + πλευρά rib; with reference to the large dark blotch above the pectoral.

#### **Osteochilus macrosemion**, new species.

Depth  $3\frac{1}{4}$ ; head 5, width  $1\frac{1}{2}$ . Snout  $3\frac{1}{4}$  in head; eye  $3\frac{2}{3}$ ,  $1\frac{1}{10}$  in snout, 2 in interorbital; maxillary reaches  $\frac{3}{4}$  to eye, length 4 in head; lip entire, narrow; jaw-edges firmly cartilaginous, trenchant; only a single pair of small barbels, rostral,  $1\frac{3}{4}$  in eye; interorbital  $1\frac{1}{2}$  in head, rather low, broadly convex; nostrils equal, together, separated by cutaneous flap; suborbitals rather narrow, cover about  $\frac{2}{3}$  of cheek to preopercular ridge. Gill rakers  $3 + 50?$ , short, feeble, points,  $\frac{1}{4}$  of gill filaments, which  $1\frac{2}{3}$  in eye. Right pharyngeal teeth 5, 3, 2, cuneate, compressed, all with broad, entire and well-developed grinding surfaces.

Scales 33 in lateral line to caudal base and 4 more on latter; 8 above, 6 below to ventral origin, 12 predorsal. Long axillary ventral scale  $2\frac{1}{2}$  in fin. Caudal base scaly. Lateral line axial, complete, tubes small and simple. Scales with 29 to 34 apical radiating striae, 0 to 4 short marginal ones basally; circuli fine, mostly basal, obsolete apically.

D. III, 15, 1, third simple ray slender, entire, prolonged until nearly reaching end of last ray when depressed, 3 in fish without caudal; A. III, 5, 1, third simple ray slender, entire,  $4\frac{1}{2}$ ; caudal 3, deeply forked, lobes pointed; least depth of caudal peduncle  $1\frac{1}{2}$  in head; pectoral 1, rays 1, 16; ventral 1, 5, fin  $3\frac{1}{2}$  in fish without caudal.

Back and upper surfaces olive, sides and below paler to whitish. Each scale on back and sides with dark brown basal spot, paler on lowest scales of side. At fifth and sixth scales of lateral line, as 2 scales above and 3 or 4 below with dark or blackish crescent. Iris grayish. Barbels pale. Dorsal with membranes before each ray and over greater upper portions dark gray, fin nearly blackish marginally. Caudal grayish, inner edge dark gray. Lower fins all whitish.

A.N.S.P., No. 60809. Srisawat, Siam. July 1934. Length 185 mm. Type.

This species is apparently distinct from the preceding and differs from all known to me in the greatly elongated front lobe of the dorsal. Only *Rohita (Rohita) triporus*, as figured by Bleeker, approaches this character, though it is with entirely different coloration and structural characters. My specimen shows no traces of pores, the scars of the pearl organs, on its snout.

(μακρὸς long + σημεῖον banner or dorsal; with references to the prolonged front dorsal lobe.)

**Osteochilus sima** (Sauvage).

Depth  $2\frac{3}{4}$  to  $2\frac{5}{8}$ ; head  $4\frac{1}{2}$  to  $4\frac{1}{2}$ , width  $1\frac{1}{2}$ . Snout  $3\frac{1}{2}$  to  $3\frac{3}{8}$  in head; eye  $3\frac{1}{4}$  to  $3\frac{3}{4}$ ,  $1\frac{1}{10}$  in snout,  $1\frac{1}{2}$  to  $1\frac{1}{2}$  in interorbital; maxillary reaches  $\frac{3}{4}$  in snout, length  $3\frac{1}{8}$  to  $3\frac{3}{8}$  in head; single pair of barbels, rostral,  $1\frac{1}{4}$  in eye; upper lip entire, narrow, lower across broad symphyseal area papillate (not fringed as described by Sauvage); jaw edges firmly cartilaginous; interorbital  $1\frac{1}{2}$  in head, broadly convex; suborbitals narrow, cover about  $\frac{1}{3}$  of cheek to preopercular ridge. Gill rakers 0 + 33, short, curved points,  $\frac{1}{4}$  of gill filaments which  $1\frac{1}{2}$  in eye. Left pharyngeal teeth 2, 3, 5, cuneate, compressed, with broad, entire, grinding surfaces.

Scales 33 in lateral line to caudal base and 3 more on latter; 8 above, 7 below (counting largely concealed scales below pointed axillary scale) to ventral origin, 6 below to anal origin, 10 to 12 predorsal. Scales on breast and chest small. Caudal base scaly. Axillary ventral scale  $2\frac{1}{4}$  to  $2\frac{1}{3}$  in fin. End of snout with 2 rows of pearl organs, of which 4 in upper row and 5 in lower, all close set. Scales with 2 to 5 short basal radiating striae and 25 or 26 apical; circuli fine, mostly basal, obsolete apically.

D. v, 15, 1, fifth simple ray  $3\frac{1}{2}$  to  $3\frac{3}{4}$  in fish without caudal; A. III, 5, 1, third simple ray 1 in head; least depth of caudal peduncle  $1\frac{3}{4}$  to  $1\frac{1}{2}$ ; pectoral 1 to  $1\frac{1}{10}$ , rays 1, 14 or 1, 15; ventral rays 1, 8, fin 4 in fish without caudal; caudal  $2\frac{3}{4}$  to  $2\frac{5}{8}$  in rest of fish, lobes slender, sharp pointed.

Back and sides above olive, each scale with dark basal spot. Sides below and under surfaces whitish. Iris gray. Barbels and lips pale or whitish. At fifth scale of lateral blackish basal crescent, one above and double series below 4 scales deep, each with similar blackish crescent. Dorsal fin with each membrane on its posterior half before ray dark to blackish gray. Caudal grayish marginally all around. Lower fins whitish.

Two, 161 to 180 mm., Srisawat, July.

This species apparently not noticed since originally described in 1878 and mentioned in 1881 as *Rohita sima* by Sauvage from the Mekong and Phnom Penh.

**Osteochilus lini**, new species. Figures 54 (head below) and 55.

Depth  $2\frac{1}{2}$  to  $3\frac{1}{4}$ ; head  $3\frac{3}{8}$  to 4, width  $1\frac{1}{2}$  to  $1\frac{3}{8}$ . Snout 3 to  $3\frac{1}{10}$  in head; eye  $3\frac{1}{8}$  to  $4\frac{1}{10}$ ,  $1\frac{1}{4}$  to  $1\frac{1}{2}$  in snout, 2 to  $2\frac{1}{10}$  in interorbital; maxillary reaches  $\frac{2}{3}$  to eye, length  $3\frac{1}{2}$  to  $3\frac{1}{2}$  in head; 2 pairs of barbels, rostral  $1\frac{1}{8}$  to 2 in maxillary which equal or little longer than eye; both lips plicate and well fringed all around, broad, fleshy; interorbital  $2\frac{1}{2}$  to  $2\frac{3}{8}$ , broadly convex; suborbitals narrow, cover about  $\frac{1}{3}$  of cheek to preopercular ridge. Gill rakers 6 + 20, short, weak points,  $\frac{1}{4}$  of gill filaments, which equal eye. Pharyngeal teeth 2, 3, 5—5, 3, 2, compressed, but slightly hooked, with broad, entire, grinding surfaces.

Scales 30 or 31 in lateral line to caudal base and 3 more on latter; 6 above, 4 below to ventral origin, 5 below to anal origin, 10 or 11 predorsal. Breast and chest covered with small scales. Axillary ventral scale  $2\frac{2}{3}$  to  $2\frac{3}{8}$  in fin. Lateral line of slender simple tubes, axial, complete. End of snout with 2 or 3 irregular rows of minute pores (scars of pearl organs), 5 or 6 in upper row and usually fewer in lower. Scales with 3 to 10 short basal radiating striae, 17 to 21 longer apical; circuli fine, mostly basal, obsolete apically.

D. III, 12, 1, third simple ray 1 to  $1\frac{1}{2}$  in head; A. III, 5, 1, third simple ray  $1\frac{1}{4}$  to  $1\frac{1}{2}$ ; least depth of caudal peduncle 2 to  $2\frac{1}{8}$ ; pectoral  $1\frac{1}{3}$  to  $1\frac{2}{3}$ , rays 1, 12; ventral I, 8, fin  $1\frac{1}{2}$  to  $1\frac{1}{4}$  in head; caudal 3 to  $3\frac{1}{4}$  in rest of fish.

Back and upper part of sides olive with brownish shade, each scale darker medially though little contrasted or as somewhat small basal spot to each scale. Fifth scale of lateral line with blackish basal crescent also scale immediately above and immediately below with similar blackish crescent. On tail posteriorly and caudal peduncle dark gray ill-defined and rather broad streaks usually as well-defined dark spot at caudal base, which may be reflected out over median caudal rays. Iris gray. Barbels with brown above, pale below. Lips whitish, like lower surface of head. Dorsal with each membrane dark gray over its posterior half or before fin ray following. Anal dark gray medially, pale marginally. Caudal grayish marginally, sometimes most of lower lobe very dark gray. Other fins pale.

A.N.S.P., No. 60812. Khao Nam Poo, Siam. October 1934. Length 84 mm. Type.

A.N.S.P., Nos. 60813 to 60842, same data, paratypes. Length 65 to 83 mm.

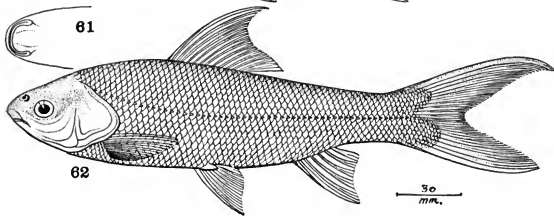
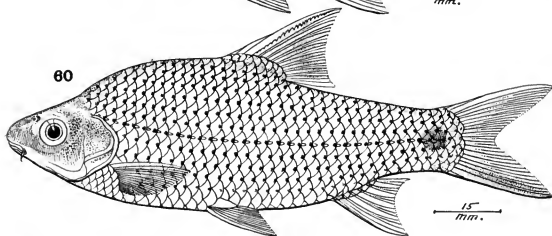
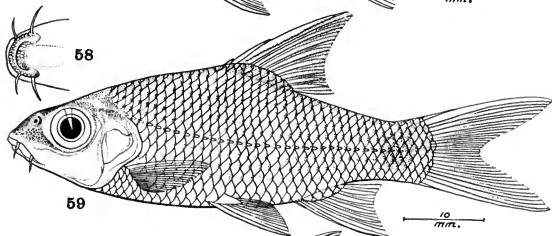
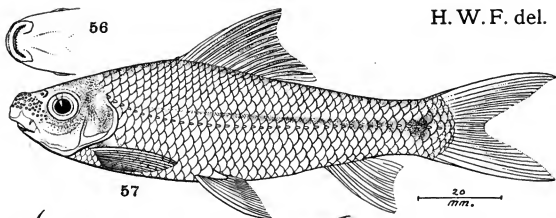
Related to *Osteochilus prosemon* Fowler 1934, but differing in 2 pairs of barbels, but 4 scales below lateral line to ventral origin and different dark blotch on lateral line.

(For Mr. S. Y. Lin, of Tingshai, in appreciation of his valuable studies on Chinese fishes.)

**Osteochilus ochrus**, new species. Figures 56 (head below) and 57.

Depth  $3\frac{2}{5}$ ; head  $3\frac{3}{8}$ , width  $1\frac{1}{4}$ . Snout  $2\frac{1}{8}$  in head; eye  $3\frac{1}{4}$ ,  $1\frac{1}{2}$  in snout,  $1\frac{1}{8}$  in interorbital; maxillary reaches  $\frac{2}{3}$  to eye, length  $3\frac{3}{8}$  in head; pair of small, short, nearly concealed maxillary barbels; upper lip smooth, thick, fleshy, only with slight marginal fringe short space before each fold at rictus; lower lip with edge fringed all around; jaw edges entire, trenchant,

H. W. F. del.

56, 57. *Ostochilus ochrus*.58, 59. *Cosmochilus harmandi*.60. *Cyclocheilichthys armatus*.61, 62. *Cirrhinus auratus*.



firmly cartilaginous; interorbital  $2\frac{3}{8}$  in head, rather low, broadly convex; suborbitals rather broad, cover nearly half of cheek to preopercular keel. Gill rakers about  $7 + 38$ , short, weak, flexible points,  $3\frac{1}{2}$  in gill filaments which  $1\frac{3}{4}$  in eye. Right pharyngeal teeth 5, 3, 2, compressed, cuneate, all with entire, broad, grinding surfaces.

Scales 38 in lateral line to caudal base and 2 more on latter; 8 above, 5 below to ventral, 6 below to anal, 11 predorsal. Breast and chest with small scales. Caudal base scaly. Axillary ventral scale  $2\frac{3}{8}$  in fin. Lateral line complete, axial, tubes small, slender, short. Scales with 2 to 10 very short, basal striae, variable and often imperfect, and 25 to 28 radiating apically; circuli fine, coarser or obsolete apically. Snout with 3 or 4 irregular close-set pearl organ scars, extend over preorbital.

D. iv, 11, 1, fourth simple ray 1 in head; A. iii, 5, 1, third simple ray  $1\frac{1}{2}$ ; least depth of caudal peduncle 2; pectoral  $1\frac{1}{2}$ , rays 1, 15; ventral rays 1, 8, fin  $1\frac{1}{2}$  in head; caudal 3 in rest of fish, well forked, lobes slender, sharp-pointed.

Upper surface of head and body olive and grayish. Darker gray-brown median streak on predorsal, along each side of dorsal fin base and down postdorsal medially. Faint lateral gray band, forming more definite dark gray diffuse spot at caudal base. Dorsal and caudal grayish, other fins whitish. Iris gray. Lips pale to whitish.

A.N.S.P., No. 61781. Bangkok, Siam. May 1934. Length 130 mm. Type.

Apparently unique among Siamese species in the presence of but 2 maxillary barbels, the disposition and number of its pearl organs on the snout, structure of its mouth and coloration.

(ὤχρὸς pale, with reference to its color.)

**Cosmochilus harmandi** Sauvage. Figures 58 (head below) and 59.

One, 70 mm., Bangkok, September 24. Agrees fundamentally with the original account based on an example 370 mm. long. The eye and barbels are greatly larger in my specimen, also the papillae of the lips, the proportions different and the fins a little shorter. Chevey 1930 gives three figures and notes of postlarval *Cosmochilus*, all of which differ in the presence of more anal rays.

**Hampala macrolepidota** (Valenciennes).

One, 253 mm., Keng Sok, February 3.

*Scaphiodontopsis acanthopterus* Fowler 1934, as Dr. H. M. Smith has informed me, is synonymous with *Scaphiodonichthys burmanicus* Vinciguerra 1890, described from Meekalan and Tao.

**Labeobarbus douronensis** (Valenciennes).

One, 140 mm., Srisawat, July.

**Labeobarbus soro** (Valenciennes).

Two, 290 to 315 mm., Keng Sok, February. These specimens quite dark, nearly gray-black above.

**Cyclocheilichthys apogon** (Valenciennes).

Two, 109 to 117 mm., Bangkok. Vertical fins dark gray, paired fins whitish and little or no trace of dark spot at caudal base.

**Cyclocheilichthys anoplos** (Bleeker).

Nine, 97 to 245 mm., Bangkok. In smallest only one scale in the lateral line with bifurcate tube.

**Cyclocheilichthys armatus** (Valenciennes). Figure 60.

Three, 106 to 123 mm., Khao Nam Poo, October. Depth  $2\frac{1}{2}$  to 3; head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ . Eye  $3\frac{1}{2}$  to  $4\frac{1}{2}$  in head; only one pair of short barbels, each on maxillary. Scales 30 to 33 in lateral line to caudal base and 3 more on latter; 7 above, 5 below to ventral, 6 below to anal, 12 predorsal.

*Cyclocheilichthys jullieni* Sauvage 1880, based on an example 330 mm. long, may possibly be the adult? It is described with the third simple dorsal ray bony and entire, depth  $3\frac{1}{2}$ , head 4, and with 6 black longitudinal bands, narrower than pale interspaces.

**Barbus spilopterus** Fowler.

Six, 70 to 117 mm., Bangkok, May, and two, 95 to 104 mm., September 24; one, 83 mm., Khao Nam Poo, October. All much larger than my original specimens. They also show 4 scales, counting the axillary, between the lateral line and the ventral origin.

**Barbus schwanefeldii** Bleeker.

Seven, 125 to 153 mm., Srisawat, July.

**Barbus binotatus** Valenciennes.

Six, 64 to 96 mm., Khao Nam Poo, October; 28 examples, 38 to 174 mm., Bangkok. Those from first locality interesting variants, as some show upper and lower caudal edges blackish, dark axial lateral streak or several black spots along axial line and black blotch at dorsal origin, also anal edge blackish.

**Barbus javanicus** Bleeker.

Four, 140 to 170 mm., Bangkok, in May, and one, 54 mm., September 24. In last rostral barbels rudimentary. Scales  $25 + 3$ ; 7 above, 4 below to ventral origin. A. III, 6, 1.

**Barbus proctozyron** (Bleeker).

Ten, 104 to 173 mm., Bangkok.

**Barbichthys laevis** (Valenciennes).

One, 174 mm. to end of broken caudal, Srisawat, July.

**Morulus erythrosticktus** Fowler.

Seven 121 to 176 mm., Bangkok.

**Cirrhinus auratus** Sauvage. Figures 61 (head below) and 62.

Depth  $3\frac{2}{3}$  to  $3\frac{3}{4}$ ; head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ , width  $1\frac{3}{4}$  to  $1\frac{1}{2}$ . Snout 4 to  $4\frac{1}{2}$  in head; eye  $5\frac{1}{2}$  to 6,  $1\frac{2}{3}$  to  $1\frac{1}{2}$  in snout,  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in interorbital; maxillary reaches  $\frac{3}{4}$  to eye, length 4 to  $4\frac{1}{2}$  in head; no barbels; lips entire, little free from trenchant, cartilaginous, firm jaw edges; interorbital  $1\frac{1}{4}$  to  $2\frac{1}{2}$ , broadly convex; suborbitals cover nearly half of cheek to preopercular ridge. Gill rakers  $10 + 60$ , short, weak, uniform points,  $\frac{1}{3}$  of gill filaments, which equal eye. Right pharyngeal teeth 5, 3, 2, compressed, with broad, entire, oblique grinding surfaces.

Scales 52 to 54 in lateral line to caudal base and 3 or 4 more on latter; 12 above, 9 below to ventral or anal, 19 predorsal. Scales on breast and chest small. Axillary ventral scale 3 in fin. Caudal base scaly. Lateral line axial, complete, small tubes simple, short. Scales with 6 to 8 feeble, imperfect, submarginal striae, and 27 to 30 apical radiating striae; circuli fine, obsolete apically.

D. III, 11, 1 or III, 12, 1, third simple ray 1 to  $1\frac{1}{2}$  in head; A. III, 5, 1, third simple ray  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; least depth of caudal peduncle  $2\frac{1}{4}$  to  $2\frac{3}{4}$ ; pectoral  $1\frac{1}{2}$  to  $1\frac{2}{3}$ , rays 1, 18; ventral I, 8, fin  $1\frac{1}{2}$  to  $1\frac{3}{4}$  in head; caudal  $2\frac{2}{3}$  to  $2\frac{3}{4}$  in rest of fish.

Back gray-brown or drab, sides below and under surfaces whitish. Iris and lips pale. Dorsal and caudal grayish marginally. Lower fins whitish.

Two, 225 to 245 mm., Bangkok.

**Cirrhinus jullieni** Sauvage. Figures 63 (head below) and 64.

Depth 3; head 4, width  $1\frac{3}{4}$ . Snout 4 in head; eye 4, 2 in interorbital; maxillary reaches  $\frac{3}{4}$  to eye, length  $4\frac{1}{2}$  in head; no barbels; lips thin, narrow, smooth, adnate with firm, cartilaginous, trenchant edges of jaws; interorbital 2 in head; suborbitals broad, cover most of cheek to preopercular ridge.

Scales  $32 + 2$  in lateral line; 6 above, 4 below to ventral origin, 5 below to anal origin, 11 predorsal. Axillary ventral scale  $\frac{3}{4}$  of fin. Caudal base scaly. Lateral line complete, very slightly decurved, axial.

D. III, 8, 1, third simple ray  $3\frac{2}{3}$  in fish to caudal base; A. III, 5, 1, third simple ray  $1\frac{1}{2}$  in head; least depth of caudal peduncle  $1\frac{3}{4}$ ; pectoral 1, rays 1, 14; ventral I, 8, fin  $1\frac{1}{10}$  in head; caudal  $2\frac{4}{5}$  in rest of fish, widely forked, slender lobes sharply pointed.

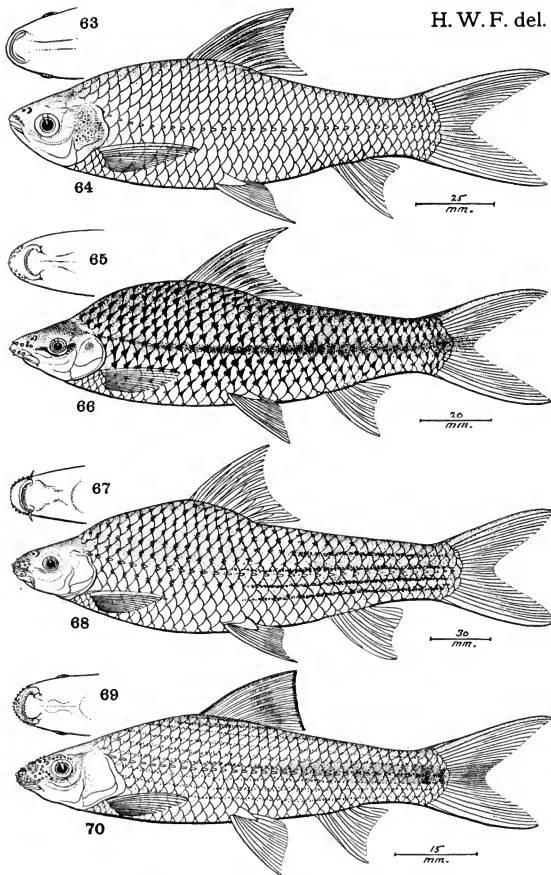
Back pale olive to brownish, sides and below pale to whitish. Iris whitish. Lips pale. Dorsal very pale grayish, each membrane medially and posteriorly before ray following, with dark gray area. Caudal grayish. Lower fins whitish.

One, 176 mm., Bangkok. Differs from the account of Sauvage in 1881 as it was said to have the lips fringed, pores 2 or 3 or more, pair of rostral barbels present shorter than eye, on an example 130 mm.

**Tylognathus melanotaenia**, new species. Figures 65 (head below) and 66.

Depth  $3\frac{1}{4}$ ; head  $4\frac{2}{3}$ , width  $1\frac{3}{4}$ . Snout  $2\frac{1}{2}$  in head; eye  $5\frac{1}{4}$ ,  $2\frac{1}{2}$  in snout,  $2\frac{3}{4}$  in interorbital; maxillary reaches  $\frac{3}{4}$  to eye, length 3 in head; maxillary with small terminal barbel, largely concealed, only tip exposed; upper lip entire, lower with greater median margin papillose; jaw edges firmly trenchant, entire; interorbital  $2\frac{1}{4}$  in head, moderately high, broadly convex;

H. W. F. del.

63, 64. *Cirrhinus jullieni*.65, 66. *Tylognathus melanotaenia*.67, 68. *Tylognathus quadrilineatus*.69, 70. *Tylognathus cryptopogon*.

suborbitals about cover half of cheek to preopercular ridge. Gill rakers  $5 + 20$ , short, feeble, uniform, flexible points,  $\frac{1}{4}$  of gill filaments, which long as eye. Right pharyngeal teeth 5, 5, 4, 2, compressed, scarcely hooked, each with oblique, entire, broad grinding surfaces.

Scales 31 in lateral line to caudal base and 3 more on latter; 6 above, 4 below to ventral origin, 5 below to anal origin, 11 predorsal. Ventral with axillary scale  $2\frac{1}{2}$  in fin. Caudal base scaled. Lateral line complete, axial, tubes small, slender, simple. Scales with 1 to 3 short basal striae, sometimes 1 to 4 short incomplete auxiliaries also, and 32 or 33 radiating apical striae; circuli fine, mostly basal, obsolete apically.

D. III, 8, 1, third simple ray  $3\frac{2}{3}$  in fish without caudal; A. III, 5, 1, third simple ray  $1\frac{1}{3}$  in head; least depth of caudal peduncle  $1\frac{3}{4}$ ; pectoral  $1\frac{1}{2}$ , rays 1, 16; ventral I, 8, fin  $1\frac{1}{2}$  in head; caudal  $2\frac{1}{4}$  in rest of fish, deeply forked, slender lobes sharply pointed.

Back olive, also upper surface of head. Along side of trunk dark brown axial band, becomes blackish along side of tail and along caudal peduncle side, also reflected out on median caudal rays. On back and sides each scale with dark or blackish brown crescent. Iris pale to whitish. Dorsal grayish olive, membranes pale and each with dark gray median area narrowly on posterior half close before ray following. Caudal gray. Other fins whitish.

A.N.S.P., No. 61502. Khao Nam Poo, Siam. October 1934. Length 158 mm. Type.

Agrees with the species following in the presence of maxillary barbels only, the squamation and fin rays. It differs in the dark or blackish axial lateral band, darker and most prominent on caudal peduncle. Its pearl organs are extensive around the front border of the snout, forming 2 rather regular rows with a third incomplete below posteriorly of smaller tubercles. Moreover the entire top of the head is finely studded or crowded with minute papillae.

(*μελας* black + *ταινία* band; with reference to the dark lateral band.)

**Tylognathus quadrilineatus**, new species. Figures 67 (head below) and 68.

Depth 3 to  $3\frac{1}{2}$ ; head  $4\frac{2}{3}$  to 5, width  $1\frac{1}{4}$  to  $1\frac{3}{4}$ . Snout  $2\frac{1}{4}$  to  $2\frac{1}{2}$  in head; eye  $4\frac{1}{3}$  to  $5\frac{1}{3}$ ,  $1\frac{1}{5}$  to  $2\frac{2}{5}$  in snout,  $2\frac{1}{2}$  to 3 in interorbital; maxillary reaches  $\frac{3}{4}$  to eye, length  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in head; single pair of short barbels, one on each maxillary, about  $\frac{1}{2}$  of eye; upper lip entire, lower with broad median area furnished with about 5 irregular rows of small papillae; jaw edges entire, firmly cartilaginous, trenchant; interorbital  $1\frac{1}{2}$  to  $1\frac{3}{4}$ , moderately high, broadly convex; suborbitals moderate, cover about half of cheek to preopercular ridge. Gill rakers  $5 + 20$ , short, uniform, flexible, feeble points,  $3\frac{1}{2}$  in gill filaments, which equal eye. Pharyngeal teeth 2, 4, 5—5, 4, 2, compressed, scarcely hooked with broad, entire grinding surfaces.

Scales 30 to 32 in lateral line to caudal base and 3 more on latter; 6 above, 4 or 5 below to ventral, 5 below to anal origin, 11 or 12 predorsal. Axillary ventral scale  $2\frac{3}{4}$  in fin. Caudal base scaly. Lateral line complete, axial along side, with small, short, simple tubes. Scales with 1 or 2 short basal striae, sometimes with as many as 5 or 6 more imperfect or incom-

plete shorter auxiliaries, and 29 to 62 apical radiating striae, more or less obsolete with age; circuli fine, basal, obsolete apically with age. Males with 4 series of pearl organs around end of snout, extend forward from below nostrils.

D. III, 8, 1, third simple ray  $3\frac{1}{2}$  to  $4\frac{2}{3}$  in fish without caudal; A. III, 5, 1, third simple ray  $1\frac{1}{2}$  to  $1\frac{1}{4}$  in head; least depth of caudal peduncle  $1\frac{2}{3}$  to  $1\frac{1}{2}$ ; pectoral 1 to  $1\frac{1}{2}$ , rays 1, 15; ventral rays I, 8, fin 1 to  $1\frac{1}{2}$  in head; caudal  $2\frac{3}{4}$  to  $3\frac{1}{2}$  in rest of fish, deeply forked, long slender lobes sharply pointed.

Back brown or olive, sides paler and below whitish. Above on body each scale with basal blackish pocket, showing through overlapping scales as subdued short dark bar. On side of tail 4 rows of blackish brown spots, parallel with lateral line. Iris grayish. Lips and mouth pale. Dorsal and caudal brownish, other fins whitish. In small or young examples second dark band on tail emphasized more blackish and ends in rather large diffused blackish blotch at caudal base.

A.N.S.P., No. 61791. Srisawat, Siam. July 1934. Length 258 mm. Type.

A.N.S.P., Nos. 61792 to 61795, same data, paratypes. Length 160 to 183 mm. Also nine, 75 to 153 mm., Khao Nam Poo, October.

Known chiefly by its coloration, especially the four blackish or dark longitudinal lines along side of tail and caudal peduncle. Small as well as large examples have the snout studded with pearl organs.

(*quadri* four + *lineatus* lined, with reference to the coloration.)

**Tylognathus brunneus** Fowler.

One, 67 mm., Bangkok, May, and five, 52 to 90 mm., September 24; seven, 82 to 118 mm., Khao Nam Poo, October. Small examples show the caudal base with a slightly dark spot, also the dorsal fin contrasted. No barbels.

**Tylognathus caudimaculatus** Fowler.

One, 127 mm., Srisawat, July.

**Tylognathus cryptopogon**, new species. Figures 69 (head below) and 70.

Depth  $3\frac{1}{4}$  to 4; head  $3\frac{1}{4}$  to  $3\frac{1}{2}$ , width  $1\frac{1}{2}$  to  $2\frac{1}{2}$ . Snout 3 to  $3\frac{1}{4}$  in head; eye 4 to  $5\frac{1}{2}$ ,  $1\frac{1}{4}$  to  $1\frac{3}{4}$  in snout, 2 to  $2\frac{1}{2}$  in interorbital; maxillary reaches  $\frac{3}{4}$  to  $\frac{1}{2}$  to eye, length  $3\frac{2}{3}$  to  $3\frac{1}{2}$  in head; a small concealed maxillary barbel in each posterior labial sulcus; upper lip entire, lower lip rather coarsely fringed or papillate its whole extent; jaw edges firmly cartilaginous, trenchant, entire; interorbital  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in head, rather low, broadly convex; sub-orbitals wide, cover most of cheek to preopercular ridge. Gill filaments  $7 + 30$ , short, weak, flexible, uniform points,  $3\frac{1}{2}$  in gill filaments, which equal eye. Pharyngeal teeth 1, 4, 5—4, 5, 4, 2, compressed, cuneate, with broad, entire, large grinding surfaces.

Scales 31 in lateral line to caudal base and 3 more on latter; 5 above, 4 below to ventral, 5 below to anal origin, 10 predorsal. Ventral axillary scale  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in fin. Small scales on breast and chest. Caudal base scaly. Lateral line complete, axial, with small, slender, simple tubes. Scales with 3 or 4 short basal striae and 11 to 15 radiating apical; circuli fine basally, fewer and coarser apically. Entire end of snout studded with pearl organs,

extend into internasal where much smaller, also row above eye or on superciliary region, others below over preorbital to lower front eye-edge and under forward surface of snout; largest tubercles around front end of snout.

D. III, 8, 1, third simple ray slender, 1 to  $1\frac{1}{2}$  in head; A. III, 5, 1, third simple ray  $1\frac{2}{3}$  to  $1\frac{1}{2}$ ; least depth of caudal peduncle 2 to  $2\frac{2}{3}$ ; pectoral  $2\frac{1}{2}$  to  $2\frac{3}{4}$ , rays 1, 16; ventral I, 5, fin  $1\frac{2}{3}$  to  $1\frac{1}{2}$  in head; caudal  $2\frac{1}{2}$  to 3 in rest of fish, deeply forked, slender lobes pointed.

Back and upper surfaces dull olive or brownish, each row of scale junctures with slightly darker longitudinal streak. At base of caudal obsolete dark gray transverse short diffuse bar and another smaller, near basal end of squamation. In small specimens these basal caudal bars may be almost blackish. Iris whitish, also lips. Dorsal largely pale gray to whitish, front and upper edge narrowly gray black, and each membrane in upper section or above middle of fin with gray black streak on its posterior area close before each ray following. Caudal grayish, sometimes each lobe may have slightly darker longitudinal streak. Other fins whitish.

A.N.S.P., No. 61273. Khao Nam Poo, Siam. October 1934. Length 104 mm. Type.

A.N.S.P., Nos. 61274 to 61282, same data, paratypes. Length 68 to 103 mm.

Differs chiefly from the species of *Tylognathus* in its concealed maxillary barbels. From *T. brunneus* Fowler and *T. caudimaculatus* Fowler it further differs in the lower lip fringed and extensive rostral pearl organs. It is also of different coloration.

(κρυπτὸς concealed + πῶγων beard; with reference to the concealed pair of maxillary barbels.)

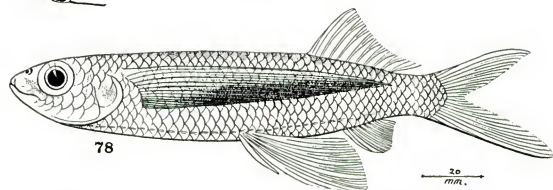
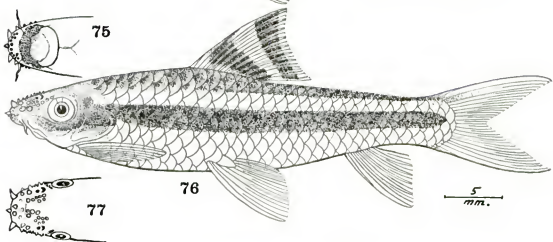
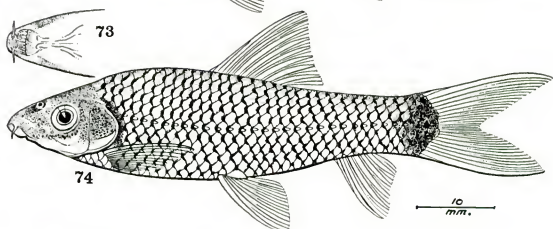
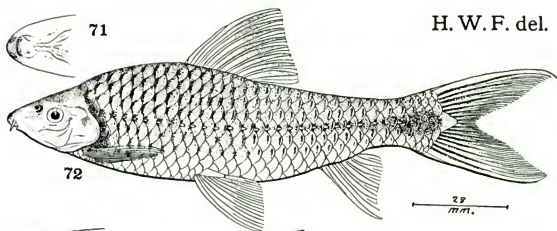
**Crossocheilus tchangii**, new species. Figures 71 (head below) and 72.

Depth  $3\frac{2}{3}$ ; head  $4\frac{1}{2}$ , width  $1\frac{1}{2}$ . Snout  $2\frac{1}{2}$  in head; eye  $5\frac{1}{4}$ ,  $2\frac{1}{2}$  in snout,  $2\frac{1}{2}$  in interorbital; maxillary reaches  $\frac{3}{4}$  to eye, length  $3\frac{1}{2}$  in head; one pair of barbels, rostral, separated by interspace equal to  $\frac{3}{4}$  of eye; upper lip plaited, broadly papillate, lower also less papillate, with submarginal series of about 7 large papillae; jaw edges firm, even, trenchant, cartilaginous; interorbital 2 in head, broadly convex; suborbitals broad, about half cover cheek to preopercular ridge. Gill rakers about 5 + 30, short, weak, slender, uniform points,  $4\frac{1}{2}$  in gill filaments, which equal eye. Right pharyngeal teeth 4, 5, 4, 2, compressed, little hooked, with broad, entire grinding surfaces.

Scales 28 in lateral line to caudal base and 2 more on latter; 5 above, 4 below to ventral or anal, 9 predorsal. Scales on chest and breast small. Axillary ventral scale  $2\frac{2}{3}$  in fin. Caudal base scaly. Lateral line complete, axial along side, of small, short, simple tubes. Muzzle, top of head and median predorsal studded very closely with minute papilla-like pearl organs.

D. III, 8, 1, third simple ray 4 in fish without caudal; A. III, 5, 1, third simple ray  $1\frac{1}{2}$  in head; least depth of caudal peduncle 2; pectoral 1, rays 1, 13; ventral I, 8, fin 1 in head; caudal  $2\frac{3}{4}$  in rest of fish, deeply forked lobes pointed.

H. W. F. del.



71, 72. *Crossocheilus tchangi*. 73, 74. *Crossocheilus reticulatus*.  
 75 to 77. *Garra taeniatops*. 78. *Cypselurus arcticeps*.



Back, head and sides above olivaceous, with darker bar at base of each scale. Under surfaces of body whitish. Along side of tail and caudal peduncle blackish band, expanding at caudal base to large blackish blotch. Iris gray or pale. Barbels brownish. Lips pale. Dorsal pale brownish, each membrane darker medially. Caudal brownish. Lower fins whitish.

A.N.S.P., No. 61690. Srisawat, Siam. July 1934. Length 173 mm. Type.

Differs from *Crossocheilus oblongus* (Valenciennes) 1842 as figured by Bleeker, in its much deeper body, different mouth structure, and different coloration. That species was reported from west of Nakon Sritamarat by Dr. H. M. Smith in 1931. *Cirrhinus* (*Crossochilus*) *cambodgiensis* Tirant 1883 is said to be closely related to *Crossocheilus oblongus* though it is said to have  $4\frac{1}{2}$  (= 5) rows of scales below the lateral line to the ventral, and in another account 3!, while the barbaric figure 1 on plate 2 is equally worthless.

(For Dr. Tehung-Lin Tehang, in appreciation of his work on Chinese cyprinoids.)

***Crossocheilus reticulatus***, new species. Figures 73 (head below) and 74.

Depth  $3\frac{3}{5}$  to  $4\frac{1}{4}$ ; head  $3\frac{2}{5}$  to  $3\frac{3}{5}$ , width  $1\frac{3}{4}$  to  $1\frac{9}{10}$ . Snout  $2\frac{3}{5}$  in head; eye  $4\frac{1}{5}$  to  $4\frac{1}{4}$ ,  $1\frac{3}{5}$  to  $1\frac{3}{4}$  in snout,  $1\frac{3}{5}$  to  $1\frac{1}{2}$  in interorbital; maxillary reaches about half way in snout, 5 in head; pair of rostral barbels only, small,  $\frac{1}{2}$  of eye; edge of upper lip with about 14 lobes and its outer surface papillate; lower lip less broadly papillate and edge not fringed; jaw edges firm, even and trenchant; interorbital  $2\frac{1}{5}$  to  $2\frac{3}{5}$  in head, broadly convex; suborbitals moderately broad, cover about  $\frac{1}{2}$  of cheek.

Scales 30 in lateral line to caudal base and 2 more on latter; 5 above, 4 below to ventral and 5 below to anal, 10 predorsal. Chest and breast with small scales. Ventral axillary scale  $\frac{1}{3}$  of fin. Caudal base scaly. Lateral line complete, axial along side of body, tubes short, simple. Scales with 15 to 17 short basal marginal striae and 18 to 22 long radiating apical striae; circuli fine basally, coarser apically. Upper surface of muzzle and head with minute papillae, rather numerous, evidently pearl organs.

D. III, 8, 1, third simple ray 1 in head; A. III, 5, 1, third simple ray  $1\frac{2}{3}$  to  $1\frac{1}{2}$ ; least depth of caudal peduncle 2 to  $2\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$  to  $1\frac{1}{4}$ , rays 1, 15; ventral I, 8,  $1\frac{1}{5}$  to  $1\frac{1}{2}$  in head; caudal  $2\frac{2}{3}$  to  $2\frac{4}{5}$  in rest of fish.

Back and upper surfaces olive brown, each scale edged with blackish brown, forming reticulate pattern. Blackish bar along behind gill-opening above pectoral. Base of caudal largely and broadly blackish. Sides of head dusted with dark brown. Iris grayish. Barbels brown. Lips whitish. Under surface of body whitish. Fins all pale to whitish, especially lower ones.

A.N.S.P., No. 61335. Khao Nam Poo, Siam. October 1934. Length 70 mm. Type.

A.N.S.P., No. 61336, same data, paratype. Length 66 mm.

Known by its coloration, especially the dark bar behind gill opening, the large black caudal spot and the dark edges to the scales, also its pale

or light-colored fins. It resembles *Crossocheilus tchangii* in mouth structure and squamation.

(*reticulatus* netted, with reference to the dark edges of the scales forming a net or chainlike pattern.)

**Garra taeniatops**, new species. Figures 75 (head below), 76 (lateral view) and 77 (head above).

Depth 4 to  $4\frac{1}{2}$ ; head  $3\frac{1}{2}$  to 4, width  $1\frac{1}{2}$  to  $1\frac{3}{4}$ . Snout  $2\frac{1}{2}$  to 3 in head; eye  $3\frac{1}{2}$  to  $3\frac{7}{8}$ ,  $1\frac{1}{2}$  to  $1\frac{1}{2}$  in snout,  $1\frac{3}{4}$  to 2 in interorbital; maxillary reaches opposite front eye edge, length from snout tip  $2\frac{3}{4}$  to  $2\frac{3}{4}$  in head; pair of short rostral barbels, widely separated as mouth width, each little shorter than eye; lower face of broad upper lip and front portion of still broader lower lip minutely papillate, posteriorly latter smooth and entire; jaw edges even, firm, trenchant; interorbital  $2\frac{1}{2}$  to  $2\frac{1}{2}$  in head, rather low, broadly convex; suborbitals narrow, would cover nearly half of cheek to preopercular ridge. Gill rakers as 8 or 10 short feeble points about  $\frac{1}{2}$  of gill filaments. Pharyngeal teeth 1 or 2, 4, 5—5, 4 or 3, 2, small, compressed, with slight entire grinding surfaces.

Scales 29 or 30 in lateral line to caudal base and 2 more on latter; 5 above, 3 below to ventral, 4 below to anal, 9 or 10 predorsal. Breast and chest with small scales. Axillary ventral scale  $3\frac{1}{2}$  to 4 in fin. Caudal base scaly. Lateral line complete, axial, with small, short, simple tubes. Scales with 9 to 10 short basal striae, 15 to 20 radiating apically, circuli moderate basally, fewer to obsolete apically. Pair of large laterally divergent pearl organs each side of snout tip, followed by row of small ones back below nostrils then to upper front edge of eye, also 2 large lower ones on front of preorbital. Upper surface of snout with small pearl organs scattered back to internasal and irregular row on lower front face of snout.

D. III, 8, 1, third simple ray  $3\frac{3}{4}$  to 4 in fish without caudal; A. III, 5, 1, third ray  $1\frac{1}{2}$  to  $1\frac{1}{2}$  in head; least depth of caudal peduncle 2 to  $2\frac{1}{2}$ ; pectoral 1 to  $1\frac{1}{2}$ , rays 1, 15; ventral rays I, 8, fin 1 in head; caudal  $2\frac{1}{2}$  to  $3\frac{1}{2}$  in rest of fish.

Back olive, sides and below paler and under surfaces whitish. Broad blackish brown lateral axial band, narrowing little on caudal base. Above adjoins narrower pale well-defined parallel band, which separated from upper side of back by dark or blackish edge delimiting olive color of back. Iris gray. Pearl organs whitish or creamy. Lips and mouth whitish. Barbels brown. Dorsal whitish, with 2 broad transverse blackish bands, upper submarginal and lower in basal half of fin. Other fins pale or whitish with grayish tints.

A.N.S.P., No. 61692. Khao Nam Poo, Siam. October 1934. Length 50 mm.

A.N.S.P., Nos. 61693 to 61746, same data, paratypes. Length 33 to 50 mm.

A diminutive species greatly resembling *Garra taeniata* H. M. Smith 1931, but differs in its larger and fewer pearl organs, depressed anal reaching caudal base, shorter barbel and different arrangement of the black bands on the dorsal fin, the upper of which exposes a narrow white margin in the

present species. Other species I described, *Garra spinosa* and *Garra fuliginosa* are without contrasted coloration and with fine numerous pearl organs. (*taeniata* +  $\psi$  appearance.)

#### LEUCISCINAE

*Barilius harmandi* (Sauvage).

Two, 208 to 264 mm., Sriracha, July.

#### SYNODONTIDAE

*Saurida tumbil* (Bloch).

Two, 198 to 255 mm., Bangkok; two, 135 to 148 mm., Sriracha.

#### BELONIDAE

*Strongylura strongylura* (Van Hasselt).

Three, 252 to 404 mm., Bangkok; one, 287 mm., Paknam, August 28; one, 140 mm., Khao Nam Poo, October. All with A. II, 14.

*Strongylura leiura* (Bleeker).

One, 325 mm., Paknam, August 28. A. II, 21, I.

*Xenentodon canciloides* (Bleeker).

One, 202 mm., Bangkok. A. II, 15.

#### HEMIRAMPHIDAE

*Hemiramphus marginatus* (Forskål).

Six, 237 to 288 mm., Bangkok; one, 254 mm., Paknam, August 28.

*Hemiramphus erythrorinchus* Le Sueur.

One, 133 mm., long without caudal, Sriracha, July 10. A. II, 12, I. Ventral origin midway between pectoral tip and caudal base.

*Hyporhamphus neglectus* (Bleeker).

Two, 144 to 154 mm., Bangkok; one, 104 mm. without beak, July 10, and one, 152 mm. long, July 24, Sriracha. A. II, 12 or II, 13.

#### EXOCOETIDAE

*Cypselurus arcticeps* (Günther). Figure 78.

Eleven, 180 to 238 mm., Bangkok; one, 182 mm., Paknam, August 28. D. III, 11 or IV, 10; A. II, 6 to II, 8. Scales 47 in lateral series to caudal base.

#### PSETTODIDAE

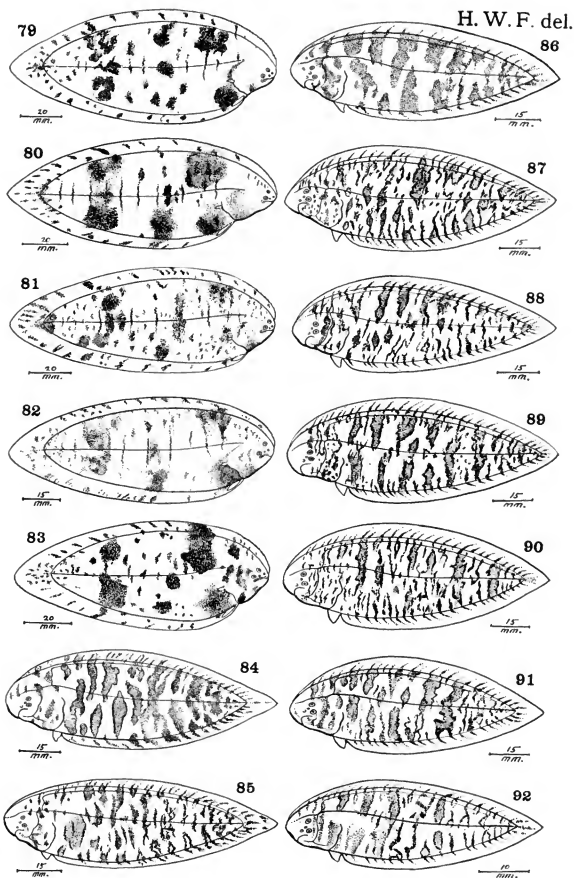
*Psettodes erumei* (Schneider).

Two, 194 to 202 mm., Bangkok.

#### BOTHIDAE

*Pseudorhombus arsius* (Buchanan-Hamilton).

Two, 163 to 224 mm., Bangkok.

79 to 83. *Synaptura orientalis*.84 to 92. *Cynoglossus puncticeps*.

**Pseudorhombus javanicus** (Bleeker).

One, 145 mm., Sriracha, July 24. Agrees with Norman's figure in most all details. Both body and fins with obscure or dark gray spots.

**SOLEIDAE****Synaptura orientalis** (Schneider). Figures 79 to 83 (variation).

Eight, 113 to 190 mm. in May and one, 55 mm., in July, from Bangkok.

*Pleuronectes orientalis* Schneider 1801, is the common genotype for *Brachirus* Swainson 1839, *Synaptura* Cantor 1850, and *Euryglossa* Kaup 1858. As Swainson's name is preoccupied, *Synaptura* Cantor is the next available.

**Synaptura commersoni** (Swainson).

Three, 123 to 204 mm., Paknam, August 28.

**Zebrias zebra** (Bloch).

One, 145 mm., Bangkok; one, 153 mm., Paknam, August 28.

**Heteromycterus hartzfeldii** (Bleeker).

One, 92 mm., Sriracha, July 24. Depth  $2\frac{3}{4}$ ; head  $3\frac{3}{4}$ . Scales 70 in lateral series. Vertical fins scaly basally. Three series of dark blotches, quite obsolete, as well as number of smaller and still more obscure dark gray spots in intervening pale areas.

**CYNOGLOSSIDAE****Trulla trigramma** (Günther). Figure 102.

One, 212 mm., Bangkok. Scales on both sides ctenoid. Lateral lines 3 on left side, with 150 scales in median and 20 above to upper lateral line; no right lateral line.

**Cynoglossus bilineatus** (Lacépède).

Two, 173 to 218 mm., Bangkok; three, 98 to 148 mm., Paknam, August 21. Scales 76 in lateral line, 15 above to upper. Right side with cycloid scales, left side with ctenoid. Depth  $3\frac{3}{4}$ .

**Cynoglossus lingua** Buchanan-Hamilton.

Two, 114 to 180 mm., Bangkok. Depth  $5\frac{1}{4}$ ; head 4. Hind end of maxillary nearer gill opening than snout tip. All scales cycloid. Two left lateral lines, 85 scales in median and 10 above to upper; one right lateral line.

**Cynoglossus puncticeps** (Richardson). Figures 84 to 92 (variation).

One, 64 mm., Bangkok, July 2 to 4; four, 101 to 113 mm. on August 21 and four, 90 to 104 mm. on August 28, Paknam. Day's figure shows 4 eyes, the posterior pair more emphasized, apparently the ones intended by the artist and likely less accurate.

**Cynoglossus cynoglossus** (Buchanan-Hamilton).

Two, 118 to 124 mm., Bangkok, May; also one, 133 mm., July 23; eight, 50 to 83 mm., August 21 and one, 118 mm., August 28, from Paknam. Depth  $3\frac{1}{4}$ ; head  $4\frac{1}{2}$ . Scales 73 in left lateral line, 15 or 16 above to upper; no right lateral line. On left or colored side olive gray, nearly uniform. All specimens quite pale or gray-white on snout and front of head. On left or white side fins quite deep gray.

Day's figure of *Cynoglossus bengalensis* is closest to my specimens. Buchanan-Hamilton's figure of *Achirus cynoglossus*, published by Hora in 1929, is apparently inaccurate, showing but one lateral line, the eyes nearly opposite and the mouth cleft reaching only  $\frac{2}{3}$  in the lower eye. Head shown as  $4\frac{2}{5}$ .

**SYNGNATHIDAE****Syngnathus djarong** Bleeker.

One, 90 mm., Bangkok. Dorsal begins on fourth caudal ring. Dark band through eye.

**Syngnathus spicifer** Rüppell.

One, 110 mm. August 28 and one 94 mm. August 21, Paknam. Dorsal begins on first caudal ring. Dark bar through eye, blotch below and bar from lateral hind eye edge backward. Belly with 13 white cross bands.

**SPHYRAENIDAE****Sphyraena jello** Cuvier.

Four, 142 to 180 mm., Bangkok; one, 174 mm., Sriracha, July 24; one, 188 mm., Paknam, August 28.

**ATHERINIDAE****Atherina valenciennesi** Bleeker.

Three, 92 to 95 mm., Sriracha, July 10.

**Atherina duodecimalis** Valenciennes.

One, 65 mm., Paknam, August 28.

**MUGILIDAE****Mugil dussumieri** Valenciennes.

Nineteen, 64 to 191 mm., Bangkok; three, 87 to 108 mm., Paknam, August 21. Adipose eyelids broad. Scales 29 in lateral series. A. III, 9. Pectoral  $1\frac{1}{2}$  in head, without axillary scale. Lower surfaces silvery white, especially in young.

**Mugil longimanus** Günther.

Ten, 76 to 170 mm., Bangkok; one, 127 mm., Paknam, August 28. Adipose eyelids wide. Scales 32 to 36 in lateral series. A. III, 9. Pectoral nearly or quite equals head, with axillary scale.

**Mugil oligolepis** Bleeker.

One, 133 mm., Bangkok; one, 100 mm., Paknam, August 28. Adipose eyelids moderate. Scales 24 to 26 in lateral series. A. III, 9. Pectoral  $1\frac{1}{2}$  in head, without axillary scale.

**POLYNEMIDAE****Eleutheronema tridactylum** (Bleeker).

Two, 82 to 129 mm., Bangkok, in May, also one 128 mm. in July. Only 3 free pectoral filaments.

**Eleutheronema tetradactylum** (Shaw).

Five, 133 to 158 mm., Bangkok, May; two, 106 to 108 mm., August 21, also one, 148 mm., August 28, from Paknam.

**Polydactylus sextarius** (Schneider).

Four, 149 to 158 mm., Bangkok. Free pectoral rays 6.

**Polydactylus dubius** (Bleeker). Figure 103.

Five, 70 to 220 mm., Bangkok; two, 104 to 115 mm., Paknam, August 28. All with 7 free pectoral filaments longest, or upper two longer than entire length of fish including caudal. Differs from Weber and Beaufort's account of *Polynemus dubius* in that they say "Pectoral . . . longer than head by almost 2 eye diameters." In my specimens this is only true of the young, as in the adults the pectoral reaches the middle of the soft dorsal and is 6 eye-diameters longer than head. *Polynemus longipectoralis* Weber and Beaufort differs in a shorter pectoral and its scales are given as 84. My specimens of the present species show 65 to 70 tubular scales in lateral line to caudal base.

**HOLOCENTRIDAE****Holocentrus ruber** (Forskål).

One, 170 mm., Sriracha, July 24.

**MASTACEMBELIDAE****Rhynchobdella aculeata** (Bloch).

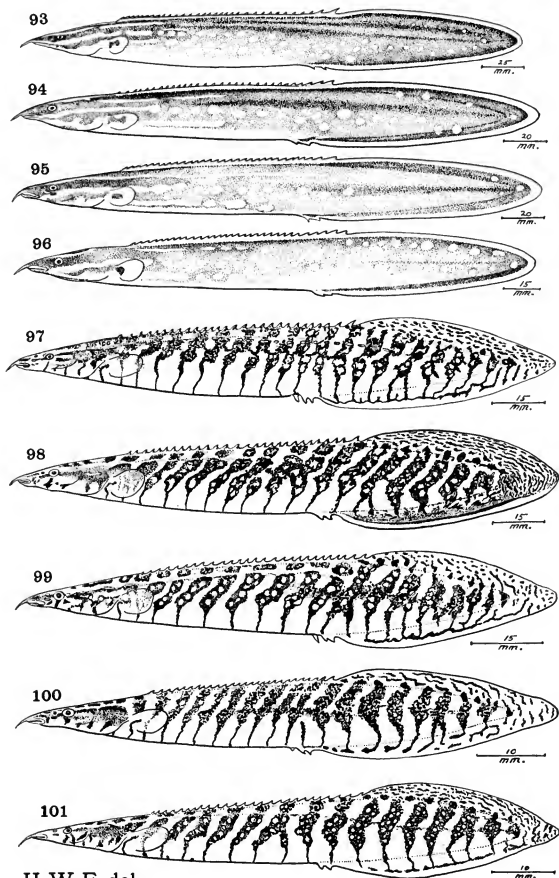
Ten, 130 to 247 mm. Bangkok. Ocelli variable, 3 to 6, though alike on each side of the same fish. None with ocellus on anal.

**Mastacembelus armatus** (Lacépède).

One, 230 mm., Bangkok.

**Mastacembelus argus** Günther. Figures 93 to 96 (variation).

Depth 9 to  $9\frac{3}{4}$ ; head  $5\frac{1}{2}$  to  $6\frac{1}{4}$ , width 3 to  $3\frac{1}{2}$ . Snout from base of nasal flap  $3\frac{1}{4}$  to  $3\frac{3}{4}$  in head; eye  $8\frac{1}{4}$  to 10,  $2\frac{2}{3}$  to  $3\frac{1}{2}$  in snout from base of nasal flap, subequal with interorbital; maxillary reaches  $\frac{3}{4}$  to  $\frac{1}{2}$  to eye, length  $3\frac{1}{2}$  to  $3\frac{3}{4}$  in head from base of nasal flap, which trifid terminally and  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in snout; strong infraorbital spine; interorbital 8 to  $8\frac{1}{2}$  in head from base of nasal flap, low. No gill rakers. Gill filaments equal eye.



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93 to 96. *Mastacembelus argus*. 97 to 101. *Mastacembelus taeniagaster*.



Scales minute, imbedded. Snout scaly on sides above lips. Lateral line distinct, axial, complete; tubes small, slender.

D. XXVIII to XXXII, rays about 73, soft fin height  $3\frac{3}{8}$  to 4 in head without nasal flap; A. II or III, 60, second spine  $3\frac{1}{4}$  to  $3\frac{1}{2}$ , soft fin height  $4\frac{3}{4}$  to  $5\frac{1}{2}$ ; caudal  $2\frac{1}{2}$  to 3, rounded behind; pectoral 3 to  $3\frac{1}{2}$ , rays 20 to 22.

Back and upper surfaces brown. On snout above narrow whitish band, forks before interorbital, then extends back along each side of back anteriorly, variously broken as spots or bars. At occiput it usually joins parallel white band to spinous dorsal which includes whole fin as well as bordering all around rest of vertical fins. From below eye parallel white band extends back over head above pectoral and back over trunk and tail as somewhat irregular row of large white spots. Still lower and variably another forms parallel and continues along lower side of abdomen. Brown line usually extends along median line of abdomen to vent. Bases of vertical fins more or less dark brown to blackish. Nasal tube brown. Iris gray. Lips largely whitish. Mandible whitish, with subterminal transverse gray band below. Pectoral whitish, with dark basal blotch.

Four, 197 to 263 mm., Bangkok, May. A variable species, briefly described by Günther 1861, and crudely figured by Von Martens in 1876.

**Mastacembelus taeniagaster**, new species. Figures 97 to 101 (variation).

Depth  $7\frac{1}{4}$  to  $8\frac{1}{4}$ ; head  $4\frac{1}{4}$  to  $5\frac{3}{4}$ , width 3 to  $3\frac{3}{8}$ . Snout from the base of nasal flap  $2\frac{1}{4}$  to  $3\frac{1}{4}$  in head; eye  $6\frac{1}{2}$  to  $7\frac{1}{2}$ ,  $2\frac{1}{4}$  to  $2\frac{1}{2}$  in snout from base of nasal flap, subequal with interorbital; maxillary reaches  $\frac{2}{3}$  to  $\frac{3}{4}$  to eye, length 4 to  $4\frac{1}{2}$  in head from base of nasal flap; nasal flap trifid, 2 to  $2\frac{1}{2}$  in snout; strong infraorbital spine; interorbital  $7\frac{1}{2}$  to 8 in head from base of nasal flap, low. No gill rakers. Gill filaments long as eye.

Scales very small, imbedded, about 155 to 160 in axial lateral series to caudal base; lateral line of 32 to 36 small, slender or narrow tubes along upper side of back and sloping lower along side of tail to middle of small caudal base. Check and side of snout scaly, top of head largely naked forward. Anal papilla usually rather long and prominent.

D. XXVI to XXVIII, 45 to 48, soft fin height  $2\frac{3}{8}$  to 4 in head without nasal flap; A. III, 41 to 43, soft fin height  $3\frac{3}{8}$  to  $3\frac{1}{2}$ ; caudal  $1\frac{1}{4}$  to  $2\frac{1}{4}$ , convex behind, little exserted from soft dorsal and anal; pectoral  $2\frac{3}{8}$  to  $2\frac{1}{2}$  in head, rays 18 to 20.

Back and sides above brown, under surfaces whitish. Dark bar across interorbital connecting eyes. Dark brown band on side of snout to eye, continued over postocular region. Parallel and adjoining above whitish band of narrower width and broken along upper side of back into narrow long bars or blotches. Under surface of head with 6 narrow dark brown contrasted cross bars, variously broken but usually more or less complete, third extending from lower eye edge. Iris gray. Nasal flap brown. Side of trunk and tail with 16 to 20 double, blackish blotches, lower little advanced so as to produce inclination and both variously variegated or marbled with paler or brownish; also from lower part of each blackish bar extends downward, narrowing nearly as line, of which 9 or 11 or those from side of trunk completely cross abdomen; on tail they variably may arch or extend down to anal fin, in young usually more or less joining with submarginal blackish line on fin little below middle in fin depth, along base of

soft dorsal bars may variably give off dark spots. Soft dorsal pale with various short, waved lines or bars, some as small spots, mostly longitudinal, and these may extend on caudal. In largest example entire subbasal part of anal dark gray or brown. Pectoral pale, with obscure or dark transverse bars.

A.N.S.P., No. 59852. Chantaboon, southeast Siam. March 1933. Length 153 mm. Type.

A.N.S.P., Nos. 59853 to 59859, same data, paratypes. Length 89 to 148 mm.

The above were all reported by me in 1934 as *Mastacembelus circumcinctus* Hora. Though similar in a general way to that species, it differs readily in the termination of the dark blotches on the anal fin. Hora describes them as "short bands on the anal" and his figure shows them a little inclined forward and reaching the edge of the anal fin. In my examples of *M. taeniagaster* they do not reach the anal edge but only the black submarginal line as indicated in the accompanying figures 97 to 101.

(ταυία band + γαστήρ belly; with reference to the black transverse lines.)

#### ANABANTIDAE

*Anabas testudineus* (Bloch).

Three, 94 to 141 mm., Bangkok.

*Betta splendens* Regan.

One, 48 mm., Bangkok. Scales 30. A. I, 24.

*Trichopodus microlepis* (Günther). Figure III.

Five, 98 to 145 mm., Bangkok. Interesting materials, as showing the long ventral ray, in each case simple and not bifid terminally where intact. All have rather short pectorals and in the young the caudal more emarginate. In my largest specimen (figured) the lower caudal lobe is more extensive than the upper and its depressed dorsal reaches  $\frac{2}{3}$  or more to the caudal base. The vertical fins are all finely and distinctly reticulated with dark gray, producing a finely pencilled appearance. Several specimens show a rather distinct basal ill-defined gray caudal spot, less than the eye in size. Anal base sometimes uniform golden or orange, again it may be marked with the pencilled or waved lines like on the tail. Regan gives the depth as 2 while my specimens show  $2\frac{2}{3}$  to  $2\frac{3}{4}$ . Eye 2 to 3 in postorbital. D. III or IV, 9 to 11. A. XI, 35 to 38.

*Deschauenseia chryseus* Fowler 1934 is therefore a synonym of *Osophromenus microlepis* Günther and of the synonym *Trichopus parvipinnis* Sauvage 1881.

*Trichopus trichopterus* (Pallas).

Sixteen, 83 to 116 mm., Bangkok, May, and one 90 mm., September 24. Quite variable in color pattern. All have back median basal caudal spot.

Dr. H. M. Smith 1932 calls attention to *Osphronemus saigonensis* Borodin 1930 as a synonym of the present species.

### CHANNIDAE

*Channa lucius* (Cuvier).

One, 245 mm., Bangkok. Scales 58 in lateral line.

### SCOMBRIDAE

*Rastrelliger kanagurta* (Rüppell).

Nine, 130 to 145 mm., Bangkok. All with 35 or 36 lower gill rakers. Agree with 12 specimens 150 to 205 mm. long from Madras, received from the Madras Fisheries Department in 1934. Mostly in agreement with Kishinouye's figure of *Rastrelliger chrysozonus* except he shows the pectoral much too low in the body depth. In all my specimens it is at least level with, if not higher, than the upper edge of the eye.

*Rastrelliger kanagurta* is best distinguished by its very long mandible, length  $1\frac{1}{2}$  or less in head. Its synonyms are *Scomber loo* Lesson 1830 and *S. microlepidotus* Rüppell 1835. Russell's figure of *Kanagurta* is shown with a large maxillary reaching opposite the hind edge of eye or  $1\frac{2}{3}$  in head from snout tip. The pectoral appears a little too low. It appears necessary to restrict it with the materials studied above. *Scomber reani* Day 1870, imperfectly described, is also said to have its maxillary reaching opposite the posterior margin of the orbit and is therefore evidently another synonym. *Scomber moluccensis* Bleeker 1858, is described with "maxillis aequalibus, superiore sub oculi parte posteriore desinente" and "vesica natatoria", characters in accord with *R. kanagurta*. Weber 1913, however, has admitted it distinct from his *S. loo* (= *R. kanagurta*). *Scomber neglectus* Van Kampen 1907, is probably a synonym.

*Scomber kanagurta* as described and figured by me in 1905 from Padang materials showing but 23 lower gill rakers is the true *Scomber chrysozonus* Rüppell 1835. Its comparative short mandible is  $1\frac{1}{4}$  in its head, a character in agreement with Rüppell's figure. Meek's *Scomber microlepidotus* from Aden, with 30 lower gill rakers, and Formosan materials with but 21 lower gill rakers, reported as *S. kanagurta* by Fowler and Bean 1922 are *S. chrysozonus* Rüppell.

*Scomberomorus commerson* (Lacépède). Figure 104 (Bangkok).

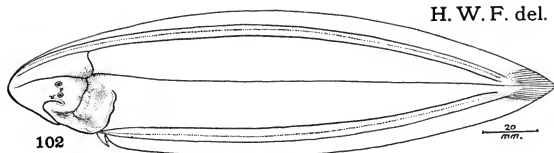
Three, 165 to 235 mm., Bangkok; one, 172 mm., Paknam, August 28.

### TRICHIURIDAE

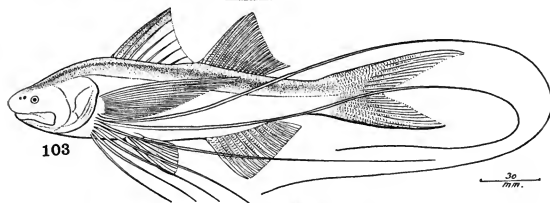
*Trichiurus haumela* (Forskål).

One, 170 mm., Bangkok. Head 8. Eye 2 in snout. Anal spines minute, distinct. Uniform whitish, dorsal pale.

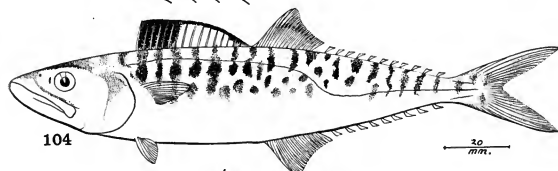
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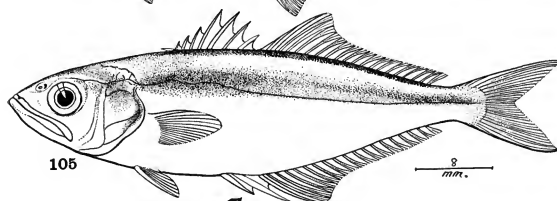
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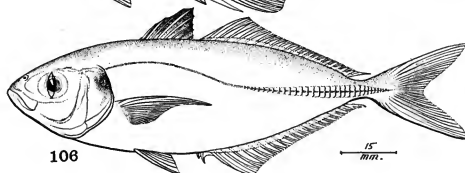
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104



105



106

102. *Trulla trigramma*.103. *Polydactylus dubius*.104. *Scomberomorus commerson*.105. *Scomberoides lysan*.106. *Alepes mate*.

**RACHYCENTRIDAE**

**Rachycentron canadum** (Linnaeus).

One, 275 mm., Bangkok.

**CARANGIDAE**

**Scomberoides lysan** (Forskål). Figure 105 (Bangkok).

One, 88 mm., Bangkok, July, and 22 specimens, 56 to 238 mm. in May; one, 130 mm., Sriracha, July 24; one, 93 mm., Paknam, August 28.

**Scomberoides tolooparah** (Rüppell).

One, 203 mm., Paknam.

**Decapterus maru-adsi** (Schlegel).

One, 178 mm., Bangkok.

Depth 4; head 3. Snout  $2\frac{1}{2}$  in head from snout tip; eye  $3\frac{3}{4}$ ,  $1\frac{1}{2}$  in snout, slightly exceeds interorbital; maxillary reaches eye, length  $2\frac{3}{4}$  in head from snout tip; interorbital  $4\frac{1}{2}$ , low, slightly convex. Lower gill rakers 33. Scutes 32. D. VIII—I, 33 + 1; A. II—I, 27 + 1; pectoral  $1\frac{1}{2}$  in head; ventral  $2\frac{1}{2}$ . Back gray, below whitish. Opercle with black spot above on hind edge, also reflected on shoulder girdle. Iris gray. Dorsals grayish, end of soft lobe whitish. Caudal and pectoral gray. Lower fins whitish.

**Selar boops** (Cuvier).

Seven, 185 to 200 mm., Bangkok.

**Trachurops crumenophthalmus** (Bloch).

One, 140 mm., Bangkok.

**Megalaspis cordyla** (Linnaeus).

Fifteen, 108 to 163 mm., Bangkok; five, 56 to 179 mm., Paknam, August 28; one, 144 mm., Sriracha, June 10.

**Alepes microbrachium** (Fowler).

One, 41 mm., Sriracha. Pectoral 4 in fish without caudal. Blackish opercular blotch reflected on shoulder girdle.

**Alepes kalla** (Cuvier).

Three, 67 to 75 mm., Bangkok, May, also one, 140 mm., July 23; three, 121 to 164 mm., Paknam, August 28.

**Alepes mate** (Cuvier). Figure 106.

One, 128 mm., Bangkok.

**Caranx sexfasciatus** Quoy and Gaimard.

Three, 103 to 158 mm., Bangkok; one, 133 mm., Sriracha, July 24; two, 88 to 92 mm., Paknam, August 28.

**Caranx guara** (Bonnaterre).

Depth  $2\frac{3}{4}$ ; head  $3\frac{1}{2}$ . Snout  $2\frac{1}{2}$  in head from snout tip; eye  $4\frac{3}{4}$ ,  $1\frac{3}{4}$  in snout,  $1\frac{3}{4}$  in interorbital, without adipose lids; maxillary reaches  $\frac{1}{2}$  in eye, length  $2\frac{1}{2}$  in head from snout tip; interorbital  $2\frac{9}{10}$ , convexly elevated. Lower

gill rakers 21. Scutes 28. Straight section of lateral line  $1\frac{2}{3}$  in arch. D. I, VIII—I, 31, first branched ray  $1\frac{2}{3}$  in total head length; A. II—I, 24, first branched ray 2; caudal  $1\frac{1}{2}$ ; ventral  $2\frac{1}{2}$ ; pectoral  $2\frac{3}{4}$  in fish without caudal. Back brown, below white. Dark shade on opercle above medianly, not distinct spot. Iris whitish. Fins brownish, lower ones whitish.

One, 191 mm., Bangkok, May.

*Longirostrum* Wakiya 1924, was proposed to replace *Selenia* Bonaparte 1846, preoccupied in Coleoptera, its genotype therefore *Caranx luna* Geoffroy St. Hilaire. He includes *Caranx platessa* Cuvier, *C. delicatissimus* Steindachner and Döderlein and *C. mertensi* Cuvier, all regarded here as synonyms of the present species. *Pseudocaranx* Bleeker 1863, monotype *Scomber dentex* Schneider, is a neglected earlier name and is here accepted as a valid subgenus, chiefly in its uniserial teeth, snout much longer than eye, no adipose eyelids and scutes only present on the posterior part of the lateral line.

**Selaroides leptolepis** (Cuvier).

Three, 101 to 110 mm., Bangkok; one, 128 mm., Sriracha, June 19.

**Carangoides praeustus** (Bennett). Figure 107 (Bangkok).

One, 161 mm., Bangkok; one, 123 mm., Sriracha, July 24, 1930. Agree with Day's figure of *Caranx ire*. General color dark gray-brown, soft dorsal and anal dark or gray-black medially, otherwise fins paler. Pectoral with dark gray blotch basally. Sides of head more or less dusky. Dorsal and anal with basal scaly sheaths of deep, narrowly exposed scales. Smaller specimen with black blotch at soft dorsal anteriorly and subterminal.

**Carangoides armatus** (Forskål).

Four, 108 to 130 mm., Bangkok, May; two, 80 to 95 mm., Paknam, August 21. Lower gill rakers 24. A. II—I, 17.

**Carangoides ciliaris** (Rüppell).

One, 113 mm., Bangkok. Depth  $1\frac{2}{3}$ . Lower gill rakers 16. A. II—I, 17. Pectoral with dark blotch. Ventral whitish.

Greatly like Cuvier's figure of *Caranx cirrhosus* Ehrenberg. This differs a little in the longer soft dorsal and anal filaments, depth 2, A. II—I, 18. It is placed as a synonym of *Carangoides armatus* by Day, who is followed by Wakiya. My example agrees in most respects with Wakiya's account and figure, except its body is deeper and the ventrals uniformly pale or whitish. As its soft anal filament is broken it was likely extended like the dorsal. The middle soft dorsal rays not extended.

**Carangoides malabaricus** (Schneider).

Eleven, 104 to 129 mm., Bangkok. Lower gill rakers 22 to 25. A. II—I, 17 or 18.

**Carangoides chrysophrys** (Cuvier).

One, 101 mm., Bangkok; one, 135 mm., Sriracha, July 10. Depth  $1\frac{1}{4}$ . Lower gill rakers 16. A. II—I, 16. Larger with pale ventrals or only slightly gray terminally, also soft dorsal and anal filaments rather short. Smaller with long first dorsal and anal rays and with much the appearance of Wakiya's figure of *Caranx (Citula) uii* 1924, except its ventrals are dusky or dark terminally.

**Gnathanodon speciosus** (Forskål).

Seven, 154 to 174 mm., Bangkok; one, 142 mm., Sriracha, June 24.

**Atropus atropus** (Bloch).

Two, 113 to 173 mm. in May and two, 195 to 198 mm., July 23, from Bangkok; one, 114 mm., June 10, and one, 65 mm., July 24, from Sriracha; one, 86 mm., Paknam, August 21.

**Scyris indica** Rüppell.

Six, 133 to 168 mm., Bangkok; one, 123 mm., Sriracha, June 10; one, 154 mm., Paknam, August 28.

## PARASTROMATEINAE, new subfamily

Differs from the other subfamilies of Carangidae in a single long dorsal fin, the spines rudimentary and the ventrals obsolete with age.

Type genus *Parastromateus* Bleeker 1865 (type *Stromateus niger* Bloch 1785) = *Apolectus* (not Bennett 1831) Cuvier 1831 = *Formio* Whitley 1927. One species.

**Parastromateus niger** (Bloch).

Five, 125 to 155 mm., Bangkok.

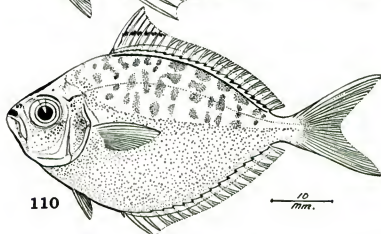
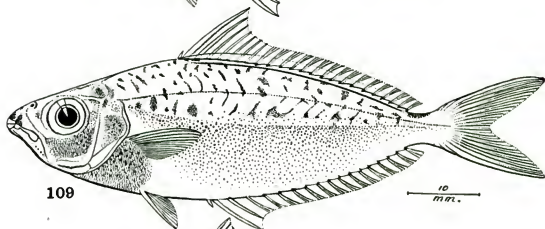
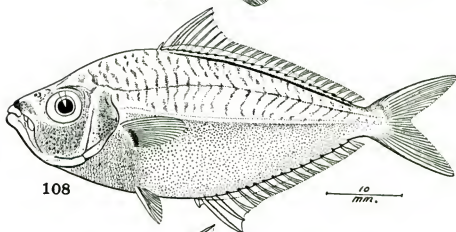
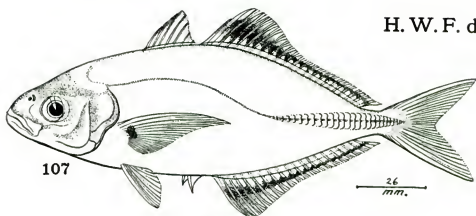
**STROMATEIDAE****Pampus chinensis** (Euphrasen).

One, 149 mm., Bangkok. Agrees with Day's fine figure.

**Pampus argenteus** (Euphrasen).

Five, 103 to 130 mm., Bangkok; one, 62 mm., Paknam, August 28. They largely agree with *Pampus simoprosopus* Fowler 1934, here regarded as a synonym, though it has a smaller pectoral, and comparatively shorter caudal lobes, also less deeply forked. In one of the present examples the greatly forked caudal has the lower lobe  $1\frac{1}{2}$  in the rest of the fish or the upper lobe  $1\frac{1}{3}$  in the lower. Pectoral  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in fish without caudal. Snout tip high in the upper profile or nearly level with upper eye edge. Russell's figure of *Sudi sandawah* shows a still more exaggerated figure with rounded snout, lower caudal and front anal lobes subequal or nearly long as rest of fish. *Stromateus securifer* Cuvier 1833, is more like *Pampus simoprosopus* in its profile, short pectoral, though its anal lobe is shorter than the dorsal and the lower caudal lobe is shorter than the moderate upper.

H. W. F. del.

107. *Carangoides pracustus*.108. *Macilenticichthys berbis*.109. *Macilenticichthys leuciscus*.110. *Leiognathus bindus*.



**LACTARIIDAE**

**Lactarius lactarius** (Schneider).

Two, 91 to 100 mm., Bangkok.

**MENIDAE**

**Mene maculata** (Schneider).

Ten, 138 to 163 mm., Bangkok.

**LEIOGNATHIDAE**

**Macilenticichthys berbis** (Valenciennes). Figure 108.

Two, 50 to 62 mm., Sriracha, June 10. *Leiognathus edwardsi* Evermann and Seale 1907, is evidently synonymous. Though its breast is said to be naked and the cheek without mention of scales, the figure appears to reveal them faintly on the latter.

**Macilenticichthys leuciscus** (Günther). Figure 109.

Two, 74 and 75 mm., Sriracha, June 10. Surely *Leiognathus stercorarius* Evermann and Seale 1907, is very similar if not synonymous. I cannot help thinking the "peculiar lanceolate area on middle of side shaded with black dots, and having the appearance of an abrasion" is an abrasion or the result of preservation.

**Leiognathus faciatius** (Lacépède).

Eight, 29 to 159 mm., Bangkok; four, 58 to 104 mm., Paknam, August 21.

**Leiognathus equula** (Forskål).

One, 69 mm., Paknam, August 28.

**Leiognathus splendens** (Cuvier).

Three, 120 to 133 mm., Bangkok.

**Leiognathus bindus** (Valenciennes). Figure 110 (young).

Four, 55 to 60 mm., Bangkok.

**Secutor insidiator** (Bloch).

Seven, 83 to 90 mm., Bangkok; eight, 48 to 80 mm., Paknam, August 21.

**Gazza equulaeformis** Rüppell.

One, 50 mm., Sriracha, June 10. Depth  $2\frac{3}{4}$ .

**CHANDIDAE**

**Ambassis wolffi** Bleeker.

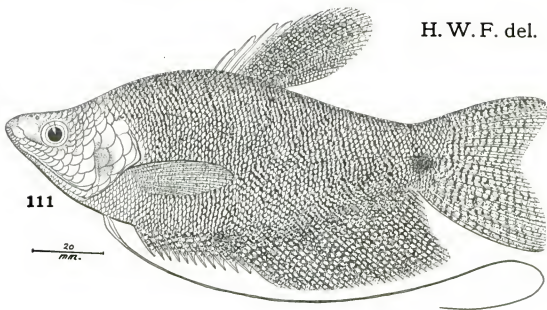
Eight, 30 to 68 mm., in July, 67 specimens, 33 to 147 mm., in May, one, 69 mm., September 24, from Bangkok.

**Ambassis gymnocephalus** (Lacépède).

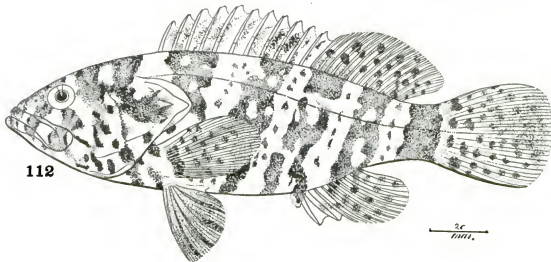
Three, 65 to 69 mm., Paknam, August 28. Bleeker's figure shows but 4 postero-supraorbital spines while in my specimens 7. He shows predorsal scales forward little beyond front pupil edge, whereas in my specimens they scarcely extend before middle of eye.

H. W. F. del.

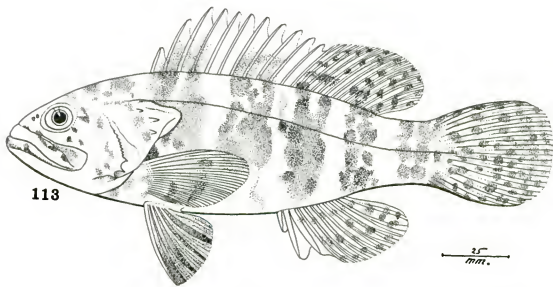
111

20  
mm.

112

25  
mm.

113

25  
mm.

111. *Trichopodus microlepis*. 112. *Serranus fasciatomaculatus*.  
113. *Serranus diacanthus*.

**Ambassis buruensis** Bleeker.

Two, 35 to 39 mm., Bangkok; one, 41 mm., Keng Sok, February 3. One or 2 postero-supraocular spines, second membrane of spinous dorsal with black spots and caudal uniformly pale.

**Ambassis kopsii** Bleeker.

Four, 79 to 87 mm., Bangkok.

**SERRANIDAE****Cephalopholis argus** Schneider.

Two, 272 to 290 mm., Bangkok.

**Cephalopholis pachycentron** (Valenciennes).

Four, 130 to 260 mm., Bangkok; one, 82 mm., June 10 and one, 108 mm., July 24, from Sriracha.

**Cephalopholis boenack** (Bloch).

Four, 178 to 275 mm., in May and one, 187 mm., June 10, from Bangkok.

**Plectropomus maculatus** (Bloch).

One, 277 mm., Bangkok.

**Serranus nebulosus** Valenciennes.

One, 227 mm., Bangkok.

**Serranus fasciatus** (Forskål).

Three, 218 to 253 mm., Bangkok; one, 245 mm., Sriracha, June 10.

**Serranus fasciatomaculatus** Peters. Figure 112 (Bangkok).

One, 136 mm., in May and one, 180 mm., July 20, from Bangkok; one, 183 mm., Sriracha, June 10.

**Serranus diacanthus** Valenciennes. Figure 113.

Five, 173 to 206 mm., Bangkok. Soft vertical fins only are largely with large black spots.

**Serranus caeruleo-punctatus** (Bloch).

Eight, 146 to 213 mm., Bangkok. Brown, with only obscure mottling. Black streak in maxillary groove. Fins, except pectoral, all more or less gray-black terminally.

**Serranus megachir** (Richardson).

Five, 177 to 217 mm., Bangkok.

**LUTJANIDAE****Lutjanus johnii** (Bloch).

Two, 128 to 180 mm., Bangkok.

**Lutjanus decussatus** (Cuvier).

One, 340 mm., Bangkok.

**Lutjanus fulviflamma** (Forskål).

Three, 143 to 222 mm., Bangkok. Largest without dark lateral blotch, so distinct in all smaller ones.

**Lutjanus vitta** (Quoy and Gaimard).

Five, 142 to 204 mm., Bangkok; one, 103 mm., Sriracha, June 10.

**Lutjanus chrysotaenia** (Bleeker).

One, 238 mm., Bangkok.

**Lutjanus lineolatus** (Rüppell).

Two, 163 to 165 mm., Bangkok; one, 100 mm., June 10 and two, 92 mm., July 24, from Sriracha.

**Lutjanus lineatus** (Quoy and Gaimard).

One, 222 mm., Bangkok. Unlike Bleeker's figure, this shows lower half of anal and all of caudal blackish.

**Lutjanus erythropterus** Bloch.

Ten, 125 to 212 mm., Bangkok; one, 220 mm., Sriracha, June 10.

**Lutjanus sebae** (Cuvier).

Three, 176 to 196 mm., Bangkok.

**POMADASYIDAE****Caesio chrysozonus** Cuvier.

Six, 110 to 150 mm., Bangkok.

**Caesio caeruleus** Lacépède.

Two, 197 to 202 mm., Bangkok.

**Caesio cuning** (Bloch).

Five, 143 to 192 mm., Bangkok.

**Plectorhinchus pictus** (Thunberg).

Two, 190 to 250 mm., Bangkok.

**Pomadasys grunniens** (Schneider).

Four, 102 to 129 mm., Bangkok; one, 137 mm., Paknam, August 28.

**Pomadasys maculatus** (Bloch).

Eleven, 118 to 173 mm., Bangkok; one, 120 mm., Sriracha, July 24; one, 47 mm., Paknam, August 21. Blackish brown blotches on back slightly variable, not exactly alike in any 2 specimens and vary on different sides of the same fish.

**Pomadasys hasta** (Bloch).

Three, 143 to 224 mm., Bangkok.

**Scolopsis vosmeri** (Bloch).

Ten, 150 to 210 mm., Bangkok; one, 147 mm., June 10 and one, 134 mm., July 20, from Sriracha. Agree with Day's figure 2, except eye larger or  $2\frac{1}{2}$  in head.

**Scolopsis temporalis** (Cuvier).

Two, 160 to 240 mm., Bangkok. Agree with McCulloch's figure and description, showing the dark transverse bar across the pectoral base. The original gaudy-colored figure of Lesson 1830, shows somewhat similar proportions though has no dark basal pectoral bar. The above specimens also show the dark longitudinal diffuse shade along the flanks as in East Indian, Philippine, and Formosan specimens.

**Scolopsis monogramma** (Cuvier). Figure 114.

One, 107 mm., Sriracha, June 19.

**TERAPONIDAE****Datnioides polota** (Buchanan-Hamilton).

Four, 62 to 223 mm., Bangkok.

**Terapon jarbua** (Forskål).

Two, 55 to 100 mm., Bangkok; one, 125 mm., Paknam, August 28.

**Terapon theraps** Cuvier. Figure 115 (young).

One, 172 mm., Bangkok; two, 40 to 148 mm., Paknam, August 28.

**LETHRINIDAE****Lethrinus hypselopterus** Bleeker.

One, 245 mm., Bangkok.

**Lethrinus frenatus** Valenciennes. Figure 116 (Sriracha).

Three, 150 to 192 mm., Bangkok; two, 120 to 128 mm., Sriracha.

**SPARIDAE****Pentapodus setosus** (Valenciennes).

Two, 195 to 230 mm., Bangkok; one, 140 mm., Sriracha, June 10.

**Synagris luteus** (Schneider).

One, 132 mm., Sriracha, June 10.

**Synagris japonicus** (Bloch).

Five, 142 to 170 mm. to end of caudal filaments, Bangkok.

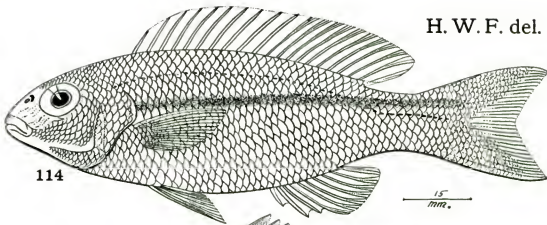
**Synagris furcosus** (Valenciennes). Figure 117.

One, 197 mm. to end of caudal filament, Bangkok, July 23. Agrees largely with Bleeker's figure of *Dentex taeniopterus*, differing slightly in little larger pectoral and caudal ending in filament above. At present no trace of lateral yellow bands as Bleeker shows.

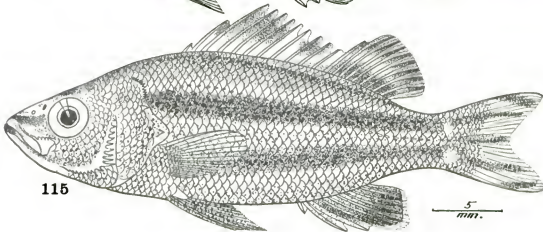
**Sparus latus** Houttuyn.

One, 98 mm., Bangkok. Depth 2½. Scales 43 in lateral line, 5 above.

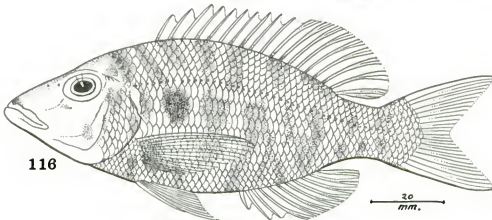
H. W. F. del.



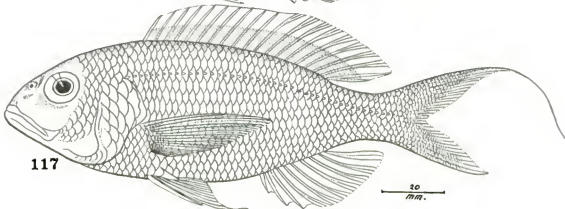
114

15  
mm.

115

5  
mm.

116

20  
mm.

117

20  
mm.

114. *Scolopsis monogramma*. 115. *Terapon theraps*.  
116. *Lethrinus frenatus*. 117. *Synagris furcosus*.

**MULLIDAE*****Upeneus sulphureus* Cuvier.**

Thirteen, 93 to 150 mm., Bangkok. Quite variable, though all with uniform caudal and its hind edge dark gray. Often quite difficult to identify formaline specimens. None of mine shows "upper caudal lobe with 4 oblique dark bands about wide as interspaces and lower lobe with 3 oblique bands", or even traces of such as I found in Philippine materials. As this is a character more like *Upeneus vittatus* likely some of the materials may refer to that species. The eye is very variable, both as to position and proportion.

***Upeneus tragula* Richardson.**

One, 168 mm., Bangkok; three, 103 to 144 mm., Sriracha, July 24.

***Pseudupeneus indicus* (Shaw).**

One, 280 mm., Bangkok.

**GERRIDAE*****Gerres abbreviatus* Bleeker.**

Four, 128 to 145 mm., Bangkok; one, 102 mm., Sriracha.

***Gerres filamentosus* Cuvier.**

Six, 125 to 175 mm., Bangkok; one, 70 mm., Sriracha, June 10.

**SILLAGINIDAE*****Sillago sihama* (Forskål).**

Four, 115 to 150 mm., in May and one, 140 mm., July 23, from Bangkok; one, 253 mm., Sriracha, July 10; two, 108 to 118 mm., Paknam, August 28.

***Sillago maculata* Quoy and Gaimard.**

One, 196 mm., Bangkok.

**SCIAENIDAE*****Otolithes argenteus* Cuvier).**

Five, 118 to 200 mm., Bangkok; one, 108 mm., Paknam, August 28. Agrees with Day's figure of *Otolithus argenteus* in its slender body and maxillary reaches below eye center.

***Otolithes ruber* (Schneider). Figure 118.**

Three, 78 to 97 mm., Bangkok; one, 121 mm., Sriracha, June 10; three, 48 to 80 mm., Paknam, August 28.

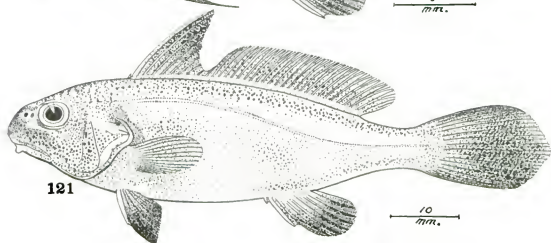
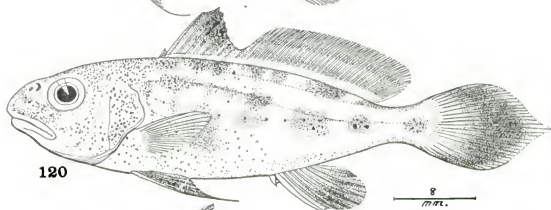
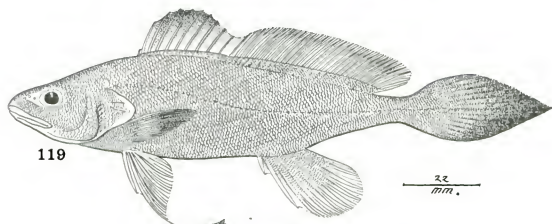
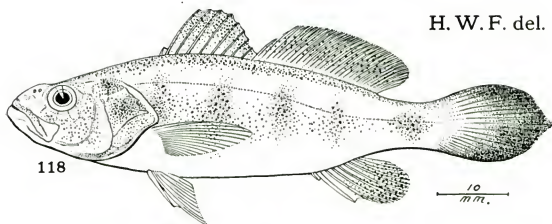
***Otolithoides siamensis* Fowler.**

Eight, 60 to 160 mm., Bangkok, May, three, 52 to 90 mm., in July; three, 98 to 122 mm., August 21 and two, 114 to 147 mm. August 28, Paknam.

***Otolithoides aeneocorpus*, new species. Figure 119.**

Depth  $3\frac{1}{2}$  to 4; head  $3\frac{1}{4}$  to  $3\frac{2}{5}$ , width  $2\frac{1}{2}$  to  $2\frac{3}{5}$ . Snout  $4\frac{1}{2}$  to  $4\frac{1}{4}$  in head; eye  $4\frac{3}{5}$  to  $5\frac{1}{4}$ ,  $1\frac{1}{2}$  to  $1\frac{1}{2}$  in snout, slightly greater than interorbital; maxillary

H. W. F. del.



118. *Otolithes ruber*.      119. *Otolithoides aeneocorpus*.  
120. *Johnius carutta*.    121. *Sciaena dussumieri*.



reaches  $\frac{1}{2}$  to  $\frac{3}{8}$  in eye, expansion  $1\frac{1}{3}$  to  $1\frac{2}{3}$  in eye, length  $2\frac{2}{3}$  to  $2\frac{3}{4}$  in head; narrow band of villiform teeth above, with outer row of large conic teeth, also band below; interorbital 5 to 6, low, broad, convex; preopercle edge with weak, small, few, feeble denticulations. Gill rakers 6 + 10, lanceolate, 2 above and below rudiments; lanceolate, longest  $\frac{1}{4}$  of eye or  $2\frac{1}{4}$  in gill filaments.

Scales 54 to 56 in lateral line to caudal base and about 38 more out over middle of caudal to its tip; 10 above, 12 below, 33 or 34 predorsal. Head largely scaly, cheeks and suborbitals cavernous. Scales small and crowded on chest and breast. Scales on sides of body all in oblique rows. Bases of vertical fins all more or less finely scaled. Scales with 6 or 7 basal radiating striae; 34 to 36 apical denticles with 4 to 6 transverse series of basal elements; circuli moderate.

D. X, I, 31 to 35, spinous fin height  $2\frac{1}{4}$  to  $2\frac{1}{2}$  in head, soft fin height  $2\frac{1}{4}$  to 3; A. II, 7, I, second spine 2 to  $2\frac{1}{3}$ , soft fin height  $1\frac{2}{3}$  to  $1\frac{3}{4}$ ; caudal 1 to  $1\frac{1}{8}$ , ends in median point behind; least depth of caudal peduncle  $4\frac{1}{4}$  to  $5\frac{1}{4}$ ; pectoral  $1\frac{1}{3}$  to  $1\frac{2}{3}$ , rays II, 15; ventral I, 5, first ray ends in filaments,  $1\frac{1}{2}$  to  $1\frac{1}{4}$  in head.

Back gray or drab, sides and below paler, evidently whitish in life. Iris gray. Spinous dorsal and caudal blackish terminally, other fins pale, with soft dorsal grayish marginally.

A.N.S.P., No. 62510. Bangkok, Siam. May 1934. Length 160 mm. Type.

A.N.S.P., Nos. 62511 to 62525, same data, paratypes. Length 78 to 158 mm. Also 2 specimens, 63 to 92 mm., Bangkok, July.

Differs in its short maxillary reaching only to about middle of eye in young and adult alike. Caudal long, pointed behind and nearly long as head. Caudal peduncle narrowly constricted or its least depth equals eye, greatly less than head. In many ways it approaches *Otolithes brunneus* (Day) but differs at once in the characters of the maxillary, caudal peduncle and caudal as noted above.

*Sciaenoides cochinchincensis* Bleeker as listed by Triant from Phuoc Hai I have been unable to locate.

(*aeneus* of brass or bronze color + *corpus* body.)

**Johnius diacanthus** (Lacépède).

Two, 139 to 160 mm., Paknam, August 28.

**Johnius coibor** (Buchanan-Hamilton).

Four, 108 to 225 mm., Bangkok. Depth  $3\frac{1}{2}$  to  $3\frac{1}{4}$ . D. 27 or 28.

**Johnius belengeri** (Cuvier).

Nine, 160 to 208 mm., Bangkok; one, 140 mm., Paknam, August 28. D. X, I, 26 to 29; A. II, 7. Known by its dark smutty coloration, fins more or less blackish in some examples, especially lower ones. Snout obtuse and short, but little longer than eye and has a very snub-nosed appearance. Often lips contrasted white.

**Johnius carutta** Bloch. Figure 120 (Bangkok).

Three, 148 to 154 mm., Bangkok, May and fifteen, 46 mm., in July; two, 48 to 85 mm., Paknam, August 21 and two, 83 to 115 mm., August 28.

**Johnius argentatus** (Houttuyn).

One, 157 mm., Paknam, August 21. Depth  $3\frac{3}{4}$ . Tubular scales 40 in lateral line to caudal base. Lower gill rakers 15. D. X, I, 27. Seems to agree with Tanaka's figure of *Sciaena argentata*. My specimen with lower jaw slightly shorter than upper and second anal spine twice eye.

**Sciaena indica** Kuhl and Van Hasselt.

One, 70 mm., Paknam, August 21.

**Sciaena dussumieri** (Valenciennes). Figure 121.

One, 69 mm., Paknam, August 21, and three, 60 to 70 mm., August 28.

### NANDIDAE

**Pristolepis fasciatus** (Bleeker).

Four, 80 to 102 mm., Bangkok.

### SCORPAENIDAE

**Scorpaenopsis novae-guineae** (Bleeker).

One, 177 mm., Bangkok; one, 153 mm., Sriracha, July 24.

**Pterois volitans** (Linnaeus).

One, 245 mm., Sriracha, June 10.

**Polycaulus uranoscopus** (Schneider).

One, 85 mm., Bangkok. Agrees with Bleeker's figure of *Polycaulus elongatus*.

### PLATYCEPHALIDAE

**Platycephalus indicus** (Linnaeus).

One, 193 mm., Bangkok.

**Grammoplites scaber** (Linnaeus).

Three, 140 to 210 mm., Bangkok; one, 84 mm., Paknam, August 21 and three, 68 to 128 mm., August 28.

**Thysanophrys crocodilus** (Tilesius).

One, 188 mm., Sriracha, June 10.

### TOXOTIDAE

**Toxotes jaculator** (Pallas).

Fifteen, 39 to 205 mm., Bangkok, May, two, 46 to 56 mm., in July; one, 90 mm., Paknam, August 28.

### EPHIPPIDAE

**Ephippus orbis** (Bloch).

Five, 112 to 138 mm., Bangkok; one, 110 mm., Sriracha, July 24.

**Drepane punctata** (Linnaeus).

Seven, 67 to 145 mm., Bangkok, May, one, 164 mm., July 23; one, 115 mm., Sriracha, July 10; thirty-eight, 24 to 93 mm., Paknam, August 21, and six, 37 to 74 mm., August 28.

**SCATOPHAGIDAE****Scatophagus argus** (Linnaeus).

Forty-two, 28 to 212 mm., Bangkok, May, two, 34 to 56 mm., July; one, 60 mm., Paknam, August 21 and one, 145 mm., August 28; three, 19 to 144 mm., Keng Sok, February 3.

**PLATACIDAE****Platax orbicularis** (Forskål). Figure 122 (Sriracha).

Two, 170 to 200 mm., Bangkok; one, 20 mm., Sriracha, July 24. When fresh brilliant vermilion, fins dusky.

**CHAETODONTIDAE****Chelmo rostratus** (Linnaeus).

Four, 162 to 180 mm., Bangkok; three, 112 to 150 mm., Sriracha, July 10 and one, 108 mm., July 24.

**Chaetodon frenatus**, new species. Figure 123.

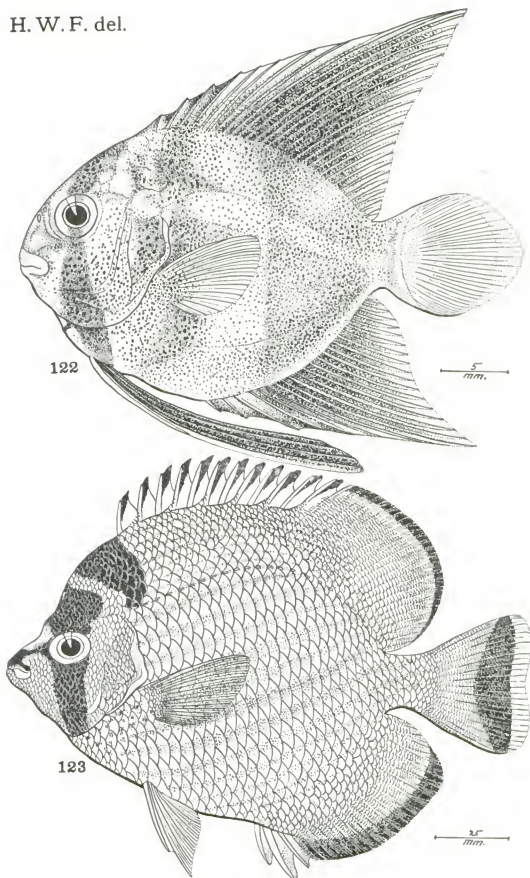
Depth  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; head 3, width 2 to  $2\frac{1}{10}$ . Snout  $2\frac{1}{4}$  to 3 in head; eye  $3\frac{1}{4}$  to  $3\frac{1}{2}$ ,  $1\frac{1}{4}$  to  $1\frac{1}{2}$  in snout,  $1\frac{1}{4}$  to  $1\frac{1}{2}$  in interorbital; maxillary reaches  $\frac{2}{3}$  to  $\frac{3}{4}$  in snout, length 4 to  $4\frac{1}{2}$  in head; interorbital  $2\frac{3}{4}$  to 3, convex, with sinuous profile; preopercle edge entire. Gill rakers 5 + 15, short points,  $\frac{1}{2}$  of gill filaments, which  $1\frac{1}{2}$  in eye.

Scales about 33 in median lateral series from head to caudal base; 22 or 23 tubular scales in lateral line, ending below last dorsal ray; 7 above, 12 below. All fins more or less finely scaled. Ventral with axillary scale  $3\frac{1}{5}$  to  $3\frac{2}{5}$  in fin. Scales with 7 to 18 basal, slightly radiating striae; 90 to 164 apical denticles, with 13 to 16 transverse series of basal elements, circuli very fine, more indefinite though fine apically.

D. XII, 24, 1 or 25, 1, fourth spine  $2\frac{1}{8}$  to  $2\frac{1}{4}$  in head, first branched ray  $1\frac{1}{3}$  to  $1\frac{2}{3}$ ; A. III, 18, 1 or 19, 1, second spine 2 to  $2\frac{1}{10}$ , fifth ray  $1\frac{1}{4}$  to  $1\frac{2}{3}$ ; caudal  $1\frac{1}{4}$  to  $1\frac{1}{2}$ , nearly truncate; least depth of caudal peduncle  $2\frac{3}{4}$  to  $3\frac{1}{4}$ ; pectoral  $1\frac{1}{4}$  to  $1\frac{1}{2}$ , rays 11, 14, ventral I, 5, fin  $1\frac{1}{10}$  to  $1\frac{1}{4}$ .

Generally yellow fading to buff in alcohol. On sides of body each row of large scales with brilliant golden band, broad, before pectoral and ventral broken into golden spots, and upper courses of bands sometimes tinged with brown to chestnut orange. On head, outer portions of vertical fins and most of paired fins whitish generally. Broad black vertical band over eye, extends down and narrowing over cheek, but not on chest. Black broadly over end of snout and extends back over preorbital to eye, variously broken in some specimens. Second black band, saddle-like, broad and close before spinous dorsal, narrowing suddenly and reaching down to upper end of gill opening, below reflected as more or less olive on opercle. Iris dark gray. Dorsal with flap behind end of each spine black, fin largely whitish basally.

H. W. F. del.

122. *Platax orbicularis*. 123. *Chaetodon frenatus*.

On soft dorsal and soft anal blackish marginal band, narrower whitish one adjoining. Black marginal band on anal much broader. Caudal with white edge behind, then broad black submarginal band and fin buff basally. Paired fins pale.

A.N.S.P., No. 62658. Bangkok, Siam. May 1934. Length 198 mm.

A.N.S.P., No. 62659 to 62665, same data, paratypes. Length 163 to 188 mm.

Related to *Chactodon bella-maris* Seale but that species described with "tip of the upper jaw black" and the figure shows but a small black sub-terminal spot on the snout. My examples of the present species show a much more extensive black blotch and variously extended back, complete or incomplete to the eye.

(*frenatus*, bridled.)

***Heniochus acuminatus*** (Linnaeus).

Four, 155 to 193 mm., Bangkok. Smallest with dorsal filament 253 mm. long.

***Holacanthus annularis*** (Bloch).

Two, 200 to 240 mm., Bangkok.

***Holacanthus sexstriatus*** Cuvier.

One, 240 mm., Bangkok.

## SIGANIDAE

***Siganus javus*** (Linnaeus).

Nine, 135 to 190 mm., Bangkok.

***Siganus concatenatus*** (Valenciennes).

Two, 155 to 215 mm., Bangkok.

***Siganus corallinus*** (Valenciennes).

Two, 203 to 240 mm., Bangkok, May and one, 235 mm., on July 23.

***Siganus virgatus*** (Valenciennes).

Ten, 164 to 185 mm., Bangkok; one, 154 mm., Sriracha, June 10.

***Siganus oramin*** (Schneider).

Ten, 119 to 131 mm., Bangkok; one, 148 mm., Sriracha, June 10.

## POMACENTRIDAE

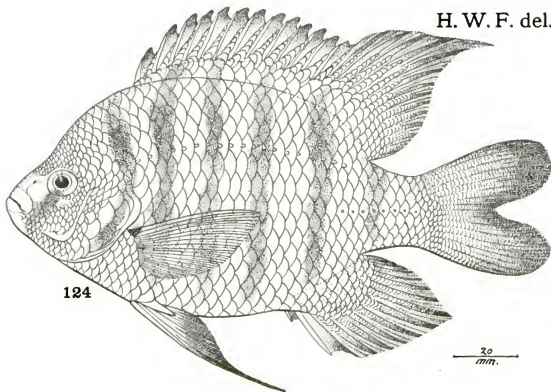
***Pomacentrus littoralis*** Cuvier.

One, 104 mm., Sriracha, June 10.

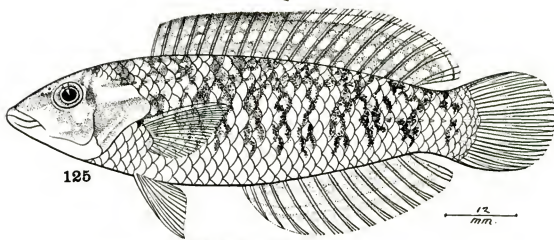
***Abudefduf saxatilis*** (Linnaeus). Figure 124 (adult from Bangkok).

Four, 165 to 173 mm., Bangkok; one, 149 mm., Sriracha, June 10. Compared with Day's figure of *Glyphidodon coelestinus* my larger specimens have a much higher and extended soft dorsal, reaching back near end of

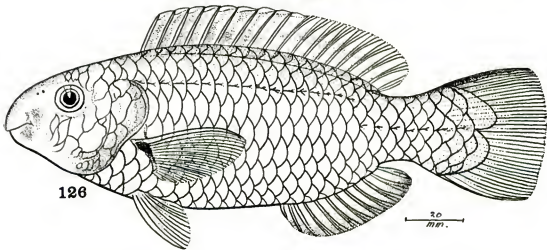
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124

30  
mm.

125

12  
mm.

126

20  
mm.

124. *Abudedefduf saxatilis*. 125. *Thalassoma schwanefeldi*.  
126. *Callyodon muricatus*.

caudal, whose lobes quite rounded. Black spot at pectoral origin very distinct and not shown by Day. The dark transverse bars variable, though always much less in width than pale interspaces.

### LABRIDAE

*Epibulus insidiator* (Pallas).

One, 320 mm., Bangkok.

*Thalassoma schwanefeldi* (Bleeker). Figure 125.

One, 93 mm., Sriracha, June 10. As Bleeker's figure of *Julis* (*Julis*) *schwanefeldi* is crude I have given the accompanying one. I have seen but one other specimen, obtained at Palawan, Philippines.

*Cheilinus fasciatus* (Bloch).

Two, 273 to 315 mm., Bangkok.

*Cheilinus chlorurus* (Bloch).

One, 292 mm., Bangkok.

### CALLYODONTIDAE

*Callyodon muricatus* (Valenciennes). Figure 126.

Eight, 168 to 192 mm., Bangkok. All young apparently, as I have seen East Indian and Philippine materials to 510 mm. Compared with Bleeker's plate they differ in upper profile convex and caudal with usually very slight convex edge and upper and lower corners not exerted. All dark mauve brown, scale center of each darker. They suggest *Scarus visayanus* Herre 1933, which appears to differ in color, its lower regions, anal and caudal yellow.

*Callyodon fasciatus* (Valenciennes). Figure 127.

One, 288 mm., Bangkok. Approaches *Pseudoscarus rivulatus* of Bleeker, but differs in the presence of but 2 scales on the preopercular flange.

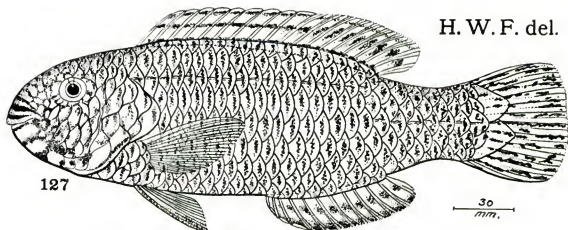
*Callyodon fuscocuneus*, new species. Figure 128.

Depth  $2\frac{1}{2}$  to 3; head  $2\frac{1}{2}$  to  $2\frac{2}{3}$ , width 2. Snout  $2\frac{1}{3}$  to  $2\frac{3}{4}$  in head; eye  $5\frac{1}{4}$  to  $5\frac{3}{4}$ ,  $2\frac{1}{4}$  to  $2\frac{2}{3}$  in snout, 2 in interorbital; rictus extends nearly half way to eye; mouth width 4 to  $4\frac{1}{2}$  in head; no posterior canines; interorbital 3, convex. Gill rakers  $12 + 24$ , slender, fine,  $3\frac{3}{4}$  in gill filaments, which subequal or slightly longer than eye.

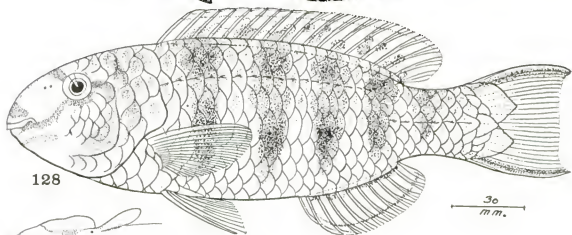
Scales  $17$  or  $18 + 5 + 1$  or 2 in lateral line; 2 above, 6 below, 7 predorsal; 3 rows on check, of which lowest row as 2 scales on preopercular flange. Scales with 18 to 20 basal radiating striae, 38 to 43 apically; circuli fine, obsolete or scale surface minutely rugose apically.

D. IX, 10, 1, first spine  $2\frac{1}{2}$  to  $3\frac{1}{2}$  in head, first ray  $2\frac{2}{3}$ ; A. III, 9, 1, first ray  $2\frac{2}{3}$  to  $2\frac{3}{4}$ ; caudal  $1\frac{1}{2}$  to  $1\frac{1}{4}$ , a little concave as folded, slightly double convex as expanded with ends slightly exerted; least depth of caudal peduncle  $2\frac{1}{4}$  to  $2\frac{1}{2}$ ; pectoral  $1\frac{2}{3}$  to  $1\frac{1}{2}$ , rays 1, 13; ventral rays I, 5, fin  $1\frac{1}{2}$  to  $1\frac{1}{3}$  in head, axillary scale  $2\frac{1}{10}$  in fin.

H. W. F. del.



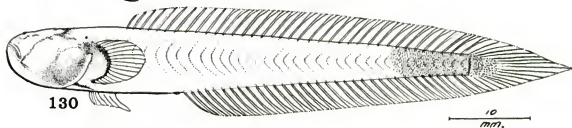
127

30  
mm.

128

30  
mm.

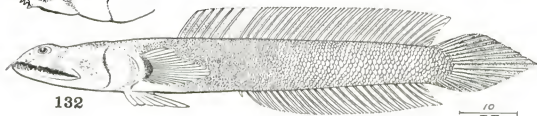
129



130

10  
mm.

131



132

10  
mm.

127. *Callyodon fasciatus*.      128. *Callyodon fuscocuneus*.  
129, 130. *Caragobius geomys*.      131, 132. *Apocryptichthys livingstoni*.



Drab, paler below, each scale on back and sides with slightly dark median area. On body 5 dark transverse bands, narrowing slightly below. Rather broad greenish transverse band from upper front eye edge across to its fellow. Broad greenish band across front of snout above upper lip, and one from rictus to lower eye edge and short space behind eye. Preopercle greenish. Greenish band across chin, rather low, not quite extended back opposite front eye edge. Iris gray. Upper dorsal edge greenish, and both fins basally with large greenish spots, variable, some smaller and subbasally invade fins. Anal pale or whitish, with greenish border, greenish ill-defined basal band. Caudal grayish, bordered above and below with greenish. Paired fins whitish, pectoral narrowly edged above and ventral in front with greenish.

A.N.S.P., No. 62771. Bangkok, Siam. May 1934. Length 255 mm. Type.

A.N.S.P., No. 62772, same data, paratype. Length 243 mm.

Similar to *Callyodon dussumieri* (Valenciennes), especially in the color pattern on the head. It differs, however, from any specimen of that species examined, in the presence of the 5 dark transverse bands on its body and the irregular greenish spots on its dorsals.

(*fuscus* dark + *cuneus* wedge; with reference to the transverse bands on the body.)

***Callyodon blochii*** (Valenciennes).

One, 240 mm., Bangkok.

#### ECHENEIDAE

***Leptecheneis naucrates*** (Linnaeus).

One, 288 mm., Bangkok; three, 217 to 280 mm., Paknam, August 28. Disk plates 23 to 26.

#### ELEOTRIDAE

***Eleotris fusca*** (Schneider).

Eleven, 78 to 156 mm., Bangkok.

***Oxyeleotris marmorata*** (Bleeker).

Three, 162 to 173 mm., Bangkok. *Callieleotris platycephalus* Fowler 1934, is evidently a synonym of this species and must be suppressed.

***Butis butis*** (Buchanan-Hamilton).

Seventeen, 55 to 132 mm., Bangkok, May, and two, 94 to 113 mm., September 24; one, 70 mm., Paknam, August 28; twelve, 38 to 82 mm., Keng Sok, February 3.

#### GOBIIDAE

***Glossogobius giurus*** (Buchanan-Hamilton).

Fifty-nine, 65 to 275 mm., Bangkok, May, and five, 69 to 128 mm., in July; one, 97 mm., Paknam, August 28; two, 61 to 89 mm., Keng Sok, February 3.

**Rhinogobius caninus** (Valenciennes).

One, 52 mm., Bangkok; four, 60 to 89 mm., Paknam, August 21 and seven, 55 to 92 mm. on August 28. Without dark lateral blotches. Each scale on side of body, however, with dark median spot. Large specimens show a divided flap on the chin below the symphyseal angle and another behind the nostril on the upper lip. My materials differ from the figures of the species in the presence of a dark gray blotch, nearly large as pupil over the opercle. The dark blotch shown above the pectoral fin origin is usually absent, though some specimens have a dark spot on the upper basal part of the pectoral fin.

**Stigmatogobius sadanundio** (Buchanan-Hamilton).

Nine, 37 to 55 mm., Bangkok.

**Pogonogobius planifrons** (Day).

One, 78 mm., Paknam.

**Vaimosa siamensis** Fowler.

Three, 35 to 37 mm., Bangkok. Only known from the type.

**Caragobius geomys**, new species. Figures 129 (head above) and 130.

Depth 7 to  $8\frac{1}{2}$ ; head  $5\frac{2}{3}$  to  $5\frac{1}{2}$ , width  $1\frac{1}{2}$  to  $1\frac{3}{4}$ . Snout  $4\frac{1}{2}$  to 5 in head from snout tip; eye very small,  $3\frac{1}{2}$  to 4 in snout, separated by less than diameter; maxillary very oblique,  $3\frac{1}{4}$  to  $4\frac{1}{2}$  in head from snout end; teeth very minute, small, apparently uniserial; tongue convex in front; small pore over each gill opening. Gill opening broad, straight, lateral, with broad isthmus below, width equals snout.

Scales small, crowded, present only on posterior fifth of body and caudal basally, about 13 or 14 scales in transverse series. About 35 muscular bands along body.

D. X, 27 or 28, origin of fin about over middle of pectoral, fin height 2 to  $2\frac{1}{2}$  in total head; A. 33 or 34, fin height 2 to  $2\frac{1}{4}$ ; pectoral  $1\frac{2}{3}$  to  $1\frac{3}{4}$ , rays 16 or 17; ventral I, 5, fin  $1\frac{1}{2}$  to 2 in head; caudal long, pointed,  $4\frac{1}{4}$  to  $5\frac{1}{4}$  in rest of fish.

Light drab, with gray shades on head. Dark gray line obliquely up from behind end of maxillary to occiput. Also one above and another below pectoral base, while latter encircled in grayish area. Fins pale or transparent.

A.N.S.P., No. 63078. Bangkok, Siam. July 2-4, 1934. Length 74 mm.

A.N.S.P., Nos. 63079 to 63082, same data, paratypes. Length 61 to 67 mm. Also from same locality one, 75 mm. in May and two, 64 to 74 mm., in July.

Differs from *Caragobius typhlops* Smith and Seale in its different physiognomy, proportions, and especially in its caudal long as head or more.

I may note that Dr. H. M. Smith in proposing *Mahidolia* 1932, has also introduced *Rictugobius* Koumans (in Smith 1932) both bearing the same genotypic name *normani*, therefore an exact synonym. As this is not mentioned in the Zoological Record so far, attention is here called to it.

(*geomys* the pocket gopher, with reference to its swollen cheeks superficially suggestive.)

***Boleophthalmus boddaerti* (Pallas).**

Twelve, 133 to 165 mm., Bangkok, May, and three, 88 to 100 mm., July 2 to 4; two, 137 to 150 mm., Paknam, August 28.

***Boleophthalmus taylori* Fowler.**

Two, 175 to 233, Bangkok; one, 170 mm., Paknam, August 28.

***Boleophthalmus smithi* Fowler.**

Eight, 85 to 115 mm., Bangkok, July and 49 specimens, 65 to 215 mm., in May; one, 178 mm., Paknam, August 8.

***Scartelaos viridis* (Buchanan-Hamilton).**

One, 110 mm., Bangkok. Long filamentous spinous dorsal  $\frac{1}{3}$  total length of fish or reaches middle of soft dorsal when depressed.

***Apocryptichthys livingstoni*, new species. Figures 131 (head above) and 132.**

Depth  $7\frac{3}{4}$  to 8; head  $3\frac{1}{4}$  to  $3\frac{1}{2}$ , width  $1\frac{3}{4}$  to  $1\frac{1}{2}$ . Snout  $5\frac{1}{2}$  to 6 in head; eye  $10\frac{3}{4}$  to 13, orbit  $7\frac{1}{4}$  to  $7\frac{1}{2}$ , subequal with snout; maxillary  $1\frac{3}{4}$  to  $1\frac{1}{2}$  in head; 2 long protruding upper front canines long as orbit, followed by row of 10 short flaring teeth each side concealed by upper lip; 11 to 13 long, protruding teeth flaring out from each side of lower jaw; posteriorly lower lip with 7 low marginal lobes before rictus; tongue little distinct from floor of mouth; flexible preorbital flap extends down over dentition of closed jaws before eye. Gill opening short, little less than orbit, mostly below pectoral base.

Head naked, also chest, breast, paired fin bases and belly little behind ventral bases. Scales cycloid, small and crowded over most of trunk, larger on tail, especially posteriorly and on caudal base. Caudal base scaly. About 50 scales in lateral axial series to caudal base and 3 or 4 more on latter; 15 or 16 transversely. Scales with 20 to 22 slightly radiating basal striae; circuli moderate, fewer or obsolete apically.

D. VI, 27, spinous fin height  $3\frac{1}{2}$  to 4 in total head length, spines flexible and joined by broad membrane with rayed fin, height of last  $2\frac{3}{4}$  to  $3\frac{1}{2}$ ; A. 25 or 26, fin height 3 to 4; caudal  $1\frac{1}{4}$  to  $1\frac{1}{2}$ , ends in median point behind; caudal peduncle depth  $3\frac{1}{2}$  to 4; pectoral  $1\frac{3}{4}$  to  $1\frac{1}{2}$ , rays 20; ventral rays I, 5, fin  $1\frac{3}{4}$  to  $1\frac{1}{2}$  in total head.

Largely gray, little lighter on under surfaces. Upper lip blackish, also end of suborbital flap. Iris gray. Lower lip quite pale or light drab. Top of head and predorsal region obscurely speckled with darker. Dorsals and caudal largely dark gray on membranes. Anal whitish, also ventrals. Pectorals with dark gray bases, fins dull brownish above, whitish below.

A.N.S.P., No. 63091. Paknam, Siam. August 28, 1934. Length 94 mm. Type.

A.N.S.P., Nos. 63092 and 63093, same data, paratypes. Length 93 and 94 mm.

Distinguished from *Apocryptichthys cantoris* Day from India and the Andamans, said to have two separate dorsal fins, about 90 scales in a lateral series, the caudal dark and longitudinally banded, and the dark caudal with some spots on its upper half.

(For Mr. C. Carey Livingston, who has entered our Siamese fishes in the museum catalogue.)

### PERIOPHTHALMIDAE

*Periopthalmus barbarus* (Linnaeus).

Two, 213 to 225 mm., Paknam, August 28.

### TAENIOIDIDAE

*Taenioides anguillaris* (Linnaeus).

Two, 210 to 236 mm., Bangkok, May and one, 108 mm. in July; one, 162 mm., Paknam, August 28. All agree and have the cutaneous ridges on the muzzle, mandible and cheeks, as shown by Ogilby and McCulloch in their figures of *Leme purpurascens* De Vis and *L. mordax* De Vis. In figures of *Amblyopus hermannianus* by Valenciennes and *Gobioides anguillaris* by Day, they are not indicated at all. My specimens also show the caudal dark gray or dusky, in contrast with the paler annectant dorsal and anal.

### TRYPAUCHENIDAE

*Trypauchen vagina* Schneider.

Eleven, 55 to 19 mm., Bangkok, May, and eleven, 54 to 80 mm. in July; two, 154 to 160 mm., Paknam, August 28.

### BATRACHOIDIDAE

*Coryzichthys gangene* (Buchanan-Hamilton).

Forty-three, 58 to 137 mm., Bangkok, May, and one, 95 mm., in July; one, 230 mm., Sriracha, July 10, and one, 73 mm., July 24; seven, 90 to 210 mm., Paknam, August 21, and two, 78 to 183 mm., August 28.

### MONACANTHIDAE

*Monacanthus chinensis* (Bloch).

Three, 185 to 255 mm., Bangkok; one, 155 mm., Sriracha, July 10.

*Chaetoderma pencilligerus* (Cuvier).

One, 188 mm., Bangkok.

*Paramonacanthus cryptodon* (Bleeker).

One, 86 mm., Bangkok. D. 28.

### TETRODONTIDAE

*Tetrodon palembangensis* Bleeker.

One, 61 mm., Srisawat, July 24.

## A NEW XANTHID CRAB FROM THE CRETACEOUS OF NEW JERSEY

BY MARY J. RATHBUN.

*Xanthias lenolensis*, new species. Text-figures 1-4.

The material consists of two palms, right and left, the right one showing the stumps of the fingers. Length of right palm across middle of outer surface 13.6; greatest height, distad to middle 8.6; greatest thickness, near



*Xanthias lenolensis*.—Fig. 1. Right manus, outer side x 3. Holotype. 2. Right manus, inner side x 3. Holotype. 3. Right manus, distal end showing bases of fingers x 3. Holotype. 4. Left manus, outer side x 3. Cotype.

middle, 5.8 mm. Upper margin arched, lower margin straight for its distal  $\frac{2}{3}$ , the proximal end curving upward and reaching a little farther backward than the upper margin. Lengthwise through the middle 2 rows of about 9 large tubercles; above and below these, a row of smaller tubercles; near lower edge a similar row. A larger tubercle at articulation with dactyl is indicated. Upper half of outer surface slightly concave; above this, the blunt upper surface bends over toward the inner surface and has three rows of irregular tubercles; below these, on the inner surface, a narrow lengthwise cavity, and further down 5 rows of tubercles more or less irregular. The basal cross-sections of the fingers are relatively small and similar, suboval and subtriangular, broader in upper half.

The left palm is much worn. Length across middle 13; greatest height, at distal end, 9.7; greatest thickness 6.8 mm. The ornamentation, so far as it can be made out, is similar to that of the minor palm.

*Type locality*.—Lenola, New Jersey. E. R. Gudehus collector, 1933. Types in collection of the Academy of Natural Sciences of Philadelphia, Cat. No. 12804.

## THE ORTHOPTERA OF COSTA RICA, PART I.—MANTIDAE

BY JAMES A. G. REHN.

### INTRODUCTION

Somewhat over thirty years ago two interesting and important collections of Costa Rican Orthoptera were placed in my hands for study. Their elaboration made known a considerable number of previously undescribed species, as well as unrecognized genera. Since that time my interest in the orthopterous fauna of that country has been active and sustained, and I have been privileged, as an Academy representative, to visit Costa Rica on two occasions, thus gaining an intimate knowledge of the distribution of life, and particularly of the Orthoptera and Dermaptera, in that physiographically varied and interesting republic.

During the past three decades, in addition to publishing a number of papers dealing wholly or in large part with Costa Rican Orthoptera, I have been assembling the necessary data for a series of comprehensive papers under the title given to this study. In these it is planned to present critical unpublished information drawn from extensive series now in hand, plus a full analysis, and revision where necessary, of the literature of the past. The present contribution on the Mantidae is the first of the series, which should be found basically useful in any work on Central American Orthoptera, as a considerable percentage of the species, and most of the genera, also occur outside of Costa Rica.

My visits to Costa Rica were made August 9 to September 15, 1923, and July 21 to September 17, 1927. Popular accounts of the same have already been printed in Academy publications.<sup>1</sup> In these will be found comments on conditions encountered at a number of localities from which material is here reported, and to them I would refer the interested reader. During my visits approximately five thousand Orthoptera and Dermaptera were collected, all of which are contained in the Academy series.

In addition to this material there are in the same collection specimens totaling more than half that number, collected and presented at various times by colleagues resident or visiting in Costa Rica. These include the late Prof. Pablo Biolley, of San José, Costa Rica, the late Prof. J. Fidel Tristán, former Director of the Museo Nacional, San José, Prof. Anastasio Alfaro, of San José, Prof. Manuel Valerio, Director of the Museo Nacional, San José, Prof. Philip P. Calvert of the University of Pennsylvania, Mr.

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<sup>1</sup> "An Entomologist's Summer Visit to Jamaica and Costa Rica," Year Book, 1923, pp. 17-34, 2 plates. "Costa Rica Revisited," Year Book, 1927, pp. 24-38, 2 plates.

C. H. Lankester, of Los Cóncevas, near Cartago, Costa Rica, and Prof. J. Chester Bradley, of Cornell University. To all, who thus aided in rounding out these contributions, the Academy wishes to extend its most cordial thanks, and the author to express to some of them his deep appreciation of the companionship of many pleasant and profitable hours in the field. In memory only can I convey to my lamented friend Prof. Tristán the personal feeling of deepest gratitude and heartfelt appreciation. Much of the success of my work in his native land was due to his self-sacrificing interest and coöperation.

Officials of the Government of Costa Rica assisted my field work in every possible way, and facilitated my movements with a consideration and thoughtfulness seldom met in other lands. The cordial assistance and coöperation of representatives of the United Fruit Company enabled me to carry on my investigations under unusually favorable conditions at particular localities. The kindness and hospitality of Señor Don Marco Aurelio Gonzalez made my 1923 stay at his hacienda at Pacayas, on the slopes of the Volcán de Irazú, most pleasant and productive.

The physiography of Costa Rica has already been discussed from the biologist's standpoint by Carriker, in his classic work on the birds of the country,<sup>2</sup> and by the Calverts in their interesting and indispensable account of entomological investigations in many sections of Costa Rica.<sup>3</sup>

The student of Costa Rican distributional biology will find the greatest possible assistance in Noriega's "Diccionario Geográfico de Costa Rica,"<sup>4</sup> and Gagini's "Diccionario de Costarriqueñismos,"<sup>5</sup> both of which have a wealth of information relative to little-known and obscure localities. The orographic map of Costa Rica prepared by Prof. H. Pittier, and published in conjunction with his paper on the orography and hydrography of the country,<sup>6</sup> will also be found of the greatest value in interpreting the physical features of the republic.

Although the present set of studies is based very largely on material belonging to the Academy, specimens belonging to the Hebard Collection, deposited at the Academy, and to the United States National Museum, the Museum of Comparative Zoölogy, and Cornell University, have been examined and reported, in each case accompanied by self-evident abbreviations

<sup>2</sup> "An annotated List of the Birds of Costa Rica including Cocos Island." By M. A. Carriker, Jr., *Ann. Carnegie Mus.*, VI, pp. 314-915, 1 map, (1910). A discussion of the geography and physiography will be found on pages 315-318, of the life-zones on pages 318-326.

<sup>3</sup> "A Year of Costa Rican Natural History." By Amelia Smith Calvert and Philip Powell Calvert. 1917. Pages xix, 576, numerous illustrations and two maps. Chapter II (pages 8-23) gives a general summary of the topography of the country.

<sup>4</sup> By Félix F. Noriega. Segunda Edición, San José. 1923. 274 pages.

<sup>5</sup> By Carlos Gagini. Segunda Edición, San José. 1919. 275 pages.

<sup>6</sup> *Kostarika, Beiträge zur Orographie und Hydrographie.* By Prof. Henri F. Pittier. Petermann's Mittheilungen, Ergänzungsheft no. 175. 1912.



of the name of the respective collections. The absence of such qualifying abbreviations means the material is the property of the Academy.

The references given in these studies under each species comprise that to the original description, those of more directly relevant synonymy, i. e. that having particular bearing on the Central American aspect of the species, and all previously published records of the occurrence of the species in Costa Rica. In working out the variation and distribution of many of the species treated, much previously unpublished information drawn from material taken elsewhere than in Costa Rica, has been included. This has been essential for a proper understanding of the subject. In consequence these studies are definitely constructive for future work on the Orthoptera of other Central American countries.

It is my intent to close the present series with a comprehensive discussion of the distribution of Orthoptera in Costa Rica, and present those conclusions of fundamental character which seem to be warranted.

### MANTIDAE

In the section of the classic "Biologia Centrali-Americana" on the Mantidae, Saussure and Zehntner<sup>7</sup> recorded five genera and eight species of the family from Costa Rica. In the intervening years a number of contributions have been published which deal in part with Costa Rican species, these chiefly by Beier, Giglio-Tos, Sjöstedt and Rehn.<sup>8</sup> In addition there also appeared the posthumously published monograph of the Mantidae by Giglio-Tos,<sup>9</sup> which paper, with its supplement, treats or lists fifteen hundred and seven species of the family.

A great increase in our knowledge of the Mantidae of Costa Rica resulted from these papers, and supplemented by the new and previously unpublished information contained in the series studied at this time, the total number of genera and species of the family now known from Costa Rica, and here discussed, has risen to twenty-seven genera and forty species, of which two genera and four species are described as new in this contribution. Of the thirty-six previously described species, thirteen are here recorded from Costa Rica for the first time. Five genera and eleven species,

<sup>7</sup> Orthoptera, I, pp. 127-197, pls. 6-10, (1894).

<sup>8</sup> Those of the last author, having special connection with the present study, are as follows:

"Studies in American Mantids or Soothsayers." Proc. U.S. Nat. Mus., XXVII, pp. 561-574, (1904). (Fourteen species recorded Costa Rica.)

"Notes on the Orthoptera of Costa Rica, with Descriptions of New Species." Proc. Acad. Nat. Sci. Phila., 1905, pp. 790-843, (1906). (Mantidae [six species], pp. 794-795.)

"Descriptions of One New Genus and Fifteen New Species of Tropical American Orthoptera," Trans. Amer. Entom. Soc., XLIV, pp. 321-372, pls. XVIII-XX, (1918). (Description of genus *Pogonogaster*.)

<sup>9</sup> Das Tierreich, Lieferung 50, pp. XL, 707, (1927).

previously described, are here first placed in synonymy, as the result of the acquisition of new material and evidence. In the present study one hundred and sixty-eight previously unrecorded specimens of Costa Rican Mantidae are reported, and in the accompanying discussions nine hundred and seventy-seven other specimens are cited or have been drawn upon for additional information here used.

I wish to acknowledge the courtesy of my colleague, Mr. Wharton Huber, in permitting me to use the photograph of *Macromantis hyalina* which appears on Plate 9. This was made by Mr. Huber from a living specimen, while at Eden, Nicaragua.

To the field entomologist the species of Mantidae are less numerous and less evident as a whole in tropical America than they are in the Oriental region or in Africa. Similarly they do not show the same proportionate increase in differentiation in the Neotropical realm noticed in so many other families of insects. It is difficult to understand why an insect-feeding group of world-wide distribution should be less conspicuous and less abundant in America, when the tremendous development and complexity of the elsewhere certainly unsurpassed and probably unequalled insect life of the neotropics is considered. The explanation must await future comparative studies of the relationship of the Old and New World elements of the family, their lines of development and differentiation, as well as possible faunistic movements.

#### *Key to the Costa Rican Genera*

The following key is purely artificial and is not intended to express my ideas as to the natural relationship or sequence of the genera considered. For these the systematic arrangement of the respective genera should be consulted. Until we are better acquainted with both sexes of a number of the units now known solely from a single sex, the preparation of a more natural key is not possible. Similarly the features given in the present table may be shared with other genera not known from Costa Rica. However, for the generic units discussed in the present study the key should prove of service, and, taken with the keys of species in the genera which are represented in Costa Rica by more than a single form, should facilitate the determination of material of all species here considered.

The construction of the key, as well as the selection of the alternatives used, is almost entirely original, as an analysis of Giglio-Tos' tables of genera, and an examination of their differential features, showed they could not be depended upon, the most trivial characters having been used as key factors, in numerous cases these being vitiated by individual variation or sexual differences.

1. Median and caudal limbs lobate, or at least lamellato-carinate, or abdomen foliaceous dilated laterad. .... 2  
 Median and caudal limbs not lobate or lamellato-carinate. Abdomen not foliaceous dilated laterad (except in *Pogonogaster* and *Carrikerella*, which have simple limbs and the abdomen also foliaceous dorsad) ..... 4
2. Pronotum and cephalic limbs short and robust ..... 3  
 Pronotum and cephalic limbs elongate, slender. (Abdomen not markedly foliaceous dilated laterad.) (Vatinae.) ..... 25
3. Dorsal surface of cephalic femora distinctly lamellato-expanded in proximal two-thirds. Dorsal surface of pronotum of female without sharp asperities. Abdomen not markedly foliaceous dilated laterad. Eyes rounded. (Acromantinae.) ..... *Antenna* Stål  
 Dorsal surface of cephalic femora not distinctly lamellato-expanded. Dorsal surface of pronotum of female with numerous sharp asperities. Abdomen markedly foliaceous dilated laterad. Eyes acute or mammillate. (Epaphroditinae.) ..... 24
4. Cephalic tibiae at distal extremities spined on dorsal surface, or with certain of the more distal internal spines distinctly diverted toward dorsal surface. (Oligonicinae.) ..... 13  
 Cephalic tibiae without distal spine on dorsal surface or internal spines distinctly diverted in the same direction ..... 5
5. Cephalic femora with three discoidal spines. Cephalic tibiae with more than eleven external spines. (Pronotum never lamellato-foliaceous dilated laterad.) (Acontiothespinae.) ..... 22  
 Cephalic femora with four discoidal spines. Cephalic tibiae with not more than eleven external spines, or if so the pronotal collar is sublamellate laterad (*Macromantis*), or whole pronotum is lamellato-foliaceous expanded laterad (*Chocradodis*.) ..... 6
6. Proximal discoidal spine of cephalic femora longer than next one distad. (General form exceedingly elongate, bacilliform, pronotum and limbs exceptionally slender.) (Schizoecephalinae.)  
*Angela* Serville  
 Proximal discoidal spine of cephalic femora shorter than next one distad ..... 7
7. Cephalic femora with five external spines. (Size very large.) <sup>10</sup>  
 (Photininae.) ..... *Macromantis* Saussure  
 Cephalic femora with four external spines <sup>10</sup> ..... 8
8. Cephalic coxae appreciably dilated in a lobation at distal extremity of flexor margin. Female sex apterous or subapterous <sup>11</sup> ..... 9  
 Cephalic coxae not dilated in a lobation at distal extremity of flexor margin. Female sex alate ..... 10
9. Cephalic femora triangularly dilated, not more than three times as long as broad. Pronotum short, supra-coxal dilation strongly marked. (Occiput with pronounced juxta-ocular lobes.) (Pseudomiopteriginae.) ..... *Pseudomiopteryx* Saussure  
 Cephalic femora slender, not dilated, more than three times as long

<sup>10</sup> The abbreviate spine generally present on the distal (genicular) lobe of the external face of the femur is not included in this count.

<sup>11</sup> At most not possessing functional alar organs.

- as broad. Pronotum elongate, supra-coxal dilation not strongly marked. .... *Musonia* Stål
10. Discoidal spines of cephalic femora disposed in zigzag. (General form depressed, but pronotum not foliaceous or lamellate expanded laterad.) (Liturgousinae.) .... *Liturgousa* Saussure
- Discoidal spines of cephalic femora disposed in a straight or weakly arcuate line. (General form not distinctly depressed, or if so pronotum is foliaceous-lamellate expanded laterad.) .... 11
11. Pronotum with two definite tubercles or bosses on cephalic portion of metazona. (Mellierinae.) .... 19
- Pronotum lacking such tubercles or bosses on cephalic portion of metazona. .... 12
12. Lateral portions of entire pronotum strongly expanded, as a whole foliaceous-lamellate, margins of same entire, non-serrate. (Choeradodinae.) .... *Chocradodis* Serville
- Lateral portions of entire pronotum not so dilated, at most marginally lamellate, with serrate armament. (Mantinae.) .... 20
13. Cephalic tibiae with several external marginal spines other than the apical one. (Cephalic femora with four discoidal spines.) *Mionycoides*, new genus
- Cephalic tibiae with no external marginal spines other than the apical one .... 14
14. Cephalic femora with four discoidal spines .... 15
- Cephalic femora with three discoidal spines .... 16
15. Distal portion of cephalic femora and all of cephalic tibiae not exceptionally slender. Supra-anal plate in both sexes elongate, lanceolate, longer than proximal width. Male sex with tegmina and wings not surpassing apex of abdomen. *Oligonicella* Giglio-Tos
- Distal portion of cephalic femora and all of cephalic tibiae exceptionally slender. Supra-anal plate in both sexes trigonal, shorter than proximal width. Male sex with tegmina and wings distinctly surpassing apex of abdomen .... *Thrinaconyx* Saussure
16. Cephalic tibiae with internal marginal spines in addition to the apical (claw) and dorsal ones. .... *Oligonyx* Saussure
- Cephalic tibiae without internal marginal spines in addition to the apical (claw) and dorsal ones .... 17
17. Body bacilliform in both sexes. Pronotum with greatest supra-coxal width equal to not more than a sixth of length of same. Abdomen very slender, subequal, non-fusiform, lacking foliaceous dorsal and lateral lamellations. .... *Thesprotia* Stål
- Body not bacilliform (females only known). Pronotum with greatest supra-coxal width greater than a fifth the length of same. Abdomen fusiform; with foliaceous dorsal and lateral lamellations. .... 18
18. No frontal process present. Supra-coxal dilation of pronotum distinctly and triangularly foliaceous expanded laterad. Foliaceous dorsal and lateral abdominal expansions with margins fimbriate. *Pogonogaster* Rehn
- Marked bifurcate frontal process present. Supra-coxal dilation of pronotum not foliaceous expanded laterad. Foliaceous dorsal and lateral abdominal expansions with margins entire. *Carrikerella* Hebard

19. Protuberances on cephalic portion of metazona of pronotum low rounded bosses or tubercles, never strongly elevated acute mammillations. Surface of pronotum without asperities; lateral margins of same not strongly denticulate.

{ *Melliera* Saussure  
{ *Phaecomantis* Beier

Protuberances on cephalic portion of metazona of pronotum pronounced and strongly elevated paired acute mammillations. Surface of pronotum with regularly distributed and marked asperities; lateral margins of same with strong, regularly spaced denticles. (Male alone known.) ..... *Xystropeltis* new genus

20. Pronotum with lateral margins distinctly but not broadly lamellate on collar and supra-coxal dilation, this area triangular in general outline. Tegmina in female not covering half of abdomen. .... *Tauromantis* Giglio-Tos

Pronotum with lateral margins lacking true lamellations, collar and supra-coxal dilation not triangular in general outline. Tegmina in female covering at least two-thirds of abdomen. .... 21

21. Facial shield at least twice as broad as deep, dorsal margin not sharply angulate mesad. Tegminal stigma linear and never accompanied by an infusate ocelliform maculation.

*Stagmomantis* Saussure

Facial shield little broader than deep, dorsal margin sharply angulate mesad. Tegminal stigma ovate or ovoid and accompanied by an infusate complete or incomplete ocelliform maculation.

*Stagmatoptera* Burmeister

22. Spines on external margin of cephalic tibiae distinctly spaced, oblique, not adpressed, decumbent or serrate in disposition. Mediastine vein of tegmina proximad with definite and regular rami. Pronotum hardly constricted in the middle of shaft. *Tithrone* Stål

Spines on external margin of cephalic tibiae not spaced, continuous, adpressed, decumbent and bluntly serrate in general disposition. Mediastine vein of tegmina without definite and regular rami. Pronotum distinctly constricted in the middle of shaft. .... 23

23. Form robust. Pronotum proportionately broader, less attenuate, transverse sulcus not strongly indicated. Tegmina and wings of male clear hyaline except for opaque tegminal costal field.

*Acontiothespis* Rehn

Form more slender (in males particularly). Pronotum proportionately narrower, more attenuate, transverse sulcus strongly indicated. Tegmina and wings of male in greater part infusate.

*Acontistella* Beier

24. Alar appendages in male when closed not truly mortuifoliateous, tegmina in part green. Costal border of male tegmina not emarginate and sinuate in distal half. Female tegmina with distal extremity rounded. Frons of female obliquely declivent.

*Metilia* Stål

Alar appendages in male when closed strongly mortuifoliateous, tegmina wood brown. Costal border of male tegmina markedly

emarginate and sinuate in distal half. Female tegmina with distal extremity produced falcate. Frons of female subvertical.

*Acanthops* Serville

25. Median and caudal limbs strongly multicarinate but non-lobate. antennae of male as a whole with articles briefly and bluntly pectinate. . . . . *Phylloates* Kirby  
Median and caudal limbs markedly multilobate. Antennae of male as a whole with articles strongly sigmoid pectinate.

*Vates* Burmeister

#### THESPINAE

#### MUSONIA Stål

*Musonia* Stål, Bihang till K. Svenska Vet.-Akad. Handl., IX, no. 10, pp. 45, 65, (1877).

Genotype (by selection of Rehn 1904<sup>12</sup>).—*Musonia* (*Thespis*) *surinama* (Saussure).

Five nominal species have been referred to *Musonia* by Giglio-Tos,<sup>13</sup> of which at least one does not properly belong to the genus,<sup>14</sup> while two others have been established as synonyms of the genotype. The remaining species are distributed from Nicaragua and Barbados to Ecuador and Guiana, as well as southward an undetermined distance into Brazil.

#### *Musonia surinama* (Saussure).

*Th[espis] surinama* Saussure, Mitth. Schweiz. Entom. Gesell., III, p. 70, (1869), [♂; Surinam].

*Musonia femoralis* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 166, pl. X, figs. 20 and 21, (1894), [♀; Chontales, Nicaragua].

*M[ionyx] fuscescens* Chopard, Ann. Soc. Entom. France, LXXX, p. 333, (1911), [♂, ♀; St. Laurent du Maroni, La Forestière and Nouveau Chantier, French Guiana].

*Musonia surinama* Hebard, Proc. Acad. Nat. Sci. Phila., LXXVI, p. 130, (1924), [Costa Rica].

El Higuito, near San Mateo. Elevation, 250 meters. January, 1906. (P. Biolley.) One male.

Oricuajo, Rio Jesús Maria.<sup>15</sup> Elevation, 225–250 feet. September 2, 1927. (Tristán and Rehn.) One male.

The synonymy given has already been established by Hebard.<sup>16</sup> The specimens here listed, the first definitely recorded with locality data from Costa Rica, have been compared with an extensive series from localities ranging from Panama and Barbados to French Guiana and Ecuador, and including the paratype specimen of Chopard's *fuscescens* mentioned by

<sup>12</sup> Proc. U.S. Nat. Mus., XXVII, p. 568, (February, 1904).

<sup>13</sup> Das Tierreich, Lief. 50, pp. 218–219, (1927).

<sup>14</sup> Originally described as a *Paramusonia*, *seclusa* Rehn belongs to that genus.

<sup>15</sup> Oricuajo is a small hamlet of a few houses on the Pacific Railroad at the crossing of the Rio Jesús Maria, about five kilometers in an air-line from the river mouth at Tivives, and about twenty-odd kilometers by rail east of Puntarenas. The Rio Machuca joins the Rio Jesús Maria at Oricuajo.

<sup>16</sup> Trans. Amer. Entom. Soc., XLVIII, p. 330, (1923).

<sup>17</sup> Idem, pp. 330–331.

Hebard.<sup>17</sup> The Costa Rican individuals are fully typical of this broadly distributed species, which is known to range as far north in Central America as Chontales, Nicaragua.

In Costa Rica *surinama* is apparently restricted to the dry forest Pacific slope. It is quite possible that the Chontales material also came from the relatively dry part of that district near Lake Nicaragua. The Oricuajo specimen was beaten from low bushes along the Pacific Railroad right-of-way, adjacent to grassy pastures, clumps of bananas and patches of cacao trees.

#### SCHIZOCEPHALINAE

##### ANGELA Serville

1839. *Angela* Serville, Hist. Nat. Ins., Orth., p. 171.

Genotype (selected by Rehn 1904<sup>18</sup>).—*A. brachyptera* (Stoll) = *purpurascens* (Olivier). Giglio-Tos in 1927<sup>19</sup> erred in stating the genotype to be *A. quinquemaculata* (Olivier), as he ignored the earlier fixation.

This genus, at least in the male sex, includes the most attenuate and slender mantids occurring in America, where their distribution is entirely tropical. But one species was previously recorded from Costa Rica, while three are contained in the series now before me. Of these the male sex alone is known of one species and solely the female of another. The following key is thus only partial in its application.

##### MALES

1. Disk of wing yellow or yellowish-white; dark band marginal, continuing proximad about peripheral margin to proximal margin, greatest width of band hardly more than one-fourth of wing length; an incomplete dark spur extends from dark border across pale disk faintly more than half-way to costal margin. .... *perpulchra* Westwood
- Disk of wing clear hyaline; dark band broad, transverse, occupying distal half of wing except for opaque distal fifth of anterior field, not extending along peripheral margin proximad; no dark spur present. .... *guianensis* Rehn

##### FEMALES

1. Form somewhat robust (for genus). Lateral margins of pronotum with numerous distinct triangular teeth, between which are placed other denticulations; third tergite of abdomen with a distinct elevated, transverse, nodulose thickening distad; wings with posterior field bearing three transverse yellow bars separated by narrow, irregular and subareolate bluish brown bars. .... *armata* (Haan)
- Form more slender. Lateral margins of pronotum unarmed except very weakly denticulate on collar and cephalad on shaft; third tergite of abdomen without transverse nodulose thickening; wings with posterior field bearing two transverse orange bars, each flanked distad by a broad, solid blue-black bar. .... *guianensis* Rehn

<sup>18</sup> Proc. U.S. Nat. Mus., XXVII, p. 655, (February, 1904).

<sup>19</sup> Das Tierreich, Lief. 50, p. 245.

**Angela perpuichra** Westwood.

*Angela perpulchra* Westwood, *Revisio Mantidarum*, p. 30, (1889), [♂; Nicaragua].  
—Rehn, *Proc. U. S. Nat. Mus.*, XXVII, p. 566, (1904), [♂; <sup>20</sup> Carrillo and Tucurrique].

The Tucurrique male is now before me. While fully typical in all respects, it is somewhat larger than the original measurements or those given for the same sex by Saussure and Zehntner,<sup>21</sup> its dimensions being: length of body, 73 mm.; length of pronotum, 26; greatest width of pronotum, 2.26; length of pronotal collar, 5; length of tegmen, 23; greatest width of tegmen, 4; length of wing, 29; greatest width of wing, 16.3; length of cephalic femur, 14.2. This individual is the one referred to by me in 1904 as having the wing disk very pale greenish-white, while that from Carrillo had the same area sulphur yellow.

The species apparently keeps to the truly tropical levels, but doubtless occurs on both slopes, as it has been taken at Bugaba, Chiriqui, Panama, which is relatively low on the Pacific side at the southern foot of the Volcán de Chiriqui.

Nicaragua, Costa Rica and Panama comprise the area from which this beautiful species is known.

**Angela armata** (Haan).

*Mantis (Thespis) armata* Haan, *Verhandl. Natuur. Geschied. Nederl. Overz. Bezitt.*, Bijd. Kenn. Orth., p. 95 (1842), [♀; no locality].

*[Angela] fulgida* Saussure, *Mélanges Orthoptér.*, II, fasc. iv, p. 61, (1872), [♀; Cayenne].

Carrillo. August to September, 1903. (Underwood.) One female. [Hebard Collection.]

The above synonymy was recently established by Uvarov,<sup>22</sup> after the examination of a photograph of Haan's type, which originally was but briefly described.

This specimen, the only individual of the species which I have examined, is fully typical, agreeing minutely in structural and color details with Saussure's original and subsequent descriptions of *fulgida*. The size, however, is somewhat greater than the measurements given by both Haan and Saussure, showing the following dimensions: length of body, 101 mm.; length of pronotum, 43; greatest width of pronotum, 4.3; length of tegmen, 22.2; greatest width of tegmen, 5.2; length of wing, 20.5; greatest width of wing, 15.5; length of cephalic femur, 21; length of caudal femur, 18.9; length of cercus, 7.1.

This single Costa Rican record gives us no opportunity to judge how extensive the area of distribution of the species may be in that country, beyond attesting its presence in the eastern forest belt.

<sup>20</sup> By a lapsus calami these specimens were reported as females.

<sup>21</sup> *Biol. Cent.-Amer., Orth.*, I, p. 158, (1894).

<sup>22</sup> *Ann. & Mag. Nat. Hist.*, (10), III, p. 74, (1929).



**Angela guianensis** Rehn.

*Angela guianensis* Rehn, Proc. Acad. Nat. Sci. Phila., 1906, p. 273, (1906), [♂, ♀; Demerara (Georgetown), British Guiana].

*Thespis infuscata* Chopard, Ann. Soc. Entom. France, LXXX, p. 320, (1911), [♂; St. Jean du Maroni and Nouveau Chantier, French Guiana].

Pozo Azul de Pirris. Elevation, 325 feet. August 24, 1927. (Lankester and Rehn; at night at light in house.) One male.

Costa Rica (exact locality unknown). (Lankester.) One male.

The above synonymy was established by Giglio-Tos,<sup>23</sup> and with two paratypes of Chopard's *infuscata* before me, both from St. Jean du Maroni, I am able to confirm his action from the evidence of type material.

The Costa Rican specimens show no noteworthy differences from French Guiana males. The species is now known to range from the lower Amazon (Obidos)<sup>24</sup> to Costa Rica, the evidence for these range extremes being before me. A female from San Esteban, State of Falcon, Venezuela<sup>25</sup> and a male from Barro Colorado Island, Canal Zone, Panama<sup>26</sup> link up the Guianan and Amazonian portion of the range with that in Costa Rica.

The single definite Costa Rican locality known for the species shows in that country it is an inhabitant of heavy lowland forest, and it is evident that the males are at night attracted to light in buildings in or near this forest. Whether it occurs on both slopes remains to be seen, Pozo Azul de Pirris being on the Pacific side. There the shelter to which the specimen was attracted was merely an open shack, in the heart of the dense forest which makes that immediate area so interesting and unusual for the Pacific coastal section.

## PSEUDOMIOPTERIGINAE

**PSEUDOMIOPTERYX** Saussure

*Pseudomiopteryx* Saussure, Mitth. Schweiz. Entom. Gesell., III, pp. 225, 228, (1870).

Included *P. spinifrons* and *bogotensis* Saussure, of which *spinifrons* was selected as the genotype by Kirby.<sup>27</sup>

Giglio Tos<sup>28</sup> has credited to this genus eight nominal species, of which, however, some may prove to be synonyms of others, or at most but geographic races. The extent of individual variation in the genus is apparently very considerable, but until extensive enough series are available to permit the necessary weighing of features on which the so-called species have been erected, it will not be possible to reach final conclusions as to their worth.

<sup>23</sup> Das Tierreich, Lief. 50, p. 249, (1927).

<sup>24</sup> Male without further data in collection of Academy.

<sup>25</sup> October to November, 1910; (M. A. Carriker, Jr.).

<sup>26</sup> April, 1924; (J. C. Bradley); [Hebard Cln.].

<sup>27</sup> Synon. Catal. Orth., I, p. 275, (1904).

<sup>28</sup> Das Tierreich, Lief. 50, pp. 253-256, (1927).

But a single species occurs in Costa Rica, and our information concerning it is probably the most extensive we have on any member of the genus.

**Pseudomiopteryx infuscata** Saussure and Zehntner. Plate 7, figures 6 and 7.

*Pseudomiopteryx infuscata* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 163, pl. IX, figs. 10-12, (1894), [♂; Presidio and Cordoba, Mexico; San Juan (Vera Paz), Las Mercedes (3000 feet), Volcan de Atitlan (2500-3500 feet) and Zapote, Guatemala; Chontales, Nicaragua; Bugaba (800-1500 feet), Caldera (1200 feet) and Volcan de Chiriqui (2500-4000 feet), Panama].—Rehn, Proc. U.S. Nat. Mus., XXVII, p. 566, (1904), [♂, ♀; Piedras Negras].—Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 795, (1906), [♂; Cachi (1000 meters)].—Picado, Bull. Scient. France et Belg., (7), XLII, p. 344, (1913), [La Mica (1400 meters)].

Atalanta Farm, Estrella Valley. Elevation, 100-150 feet. September 7 and 10, 1927. (Rehn; swept from bare ground and hiding in dead banana leaves.) Five immature males, one immature female.

La Emilia, Guápiles District. Elevation, 1000 feet. September 13 and 15, 1927. (Rehn; beaten from dead banana leaves.) One male, one female, two immature males.

Mile-post 52 on Atlantic railroad (near Peralta). May, 1928. (Lankester.) One male.

La Florida. (Lankester.) One male.

Pejivalle. Elevation, 1850-2100 feet. August 11-12, 1927. (Rehn; beaten from low cover in hill-slope forest and shaken from dead banana leaves.) Two immature males.

Cachi. One dated April 4, 1916. (Lankester.) Three males.

San José. May, 1909. (Tristán; at electric light.) One male.

Las Concavas, near Dulce Nombre, between Paraiso and Cartago. Elevation, 4550 feet. July 22 and 23, 1927. (Lankester and Rehn; at night resting on orchid in orchid house and attracted to light.) Two males.

Palomo. Elevation, 1300 meters. April. (C. Picado; in epiphytic bromeliad.) One male.

Eseazú. Elevation, 1178 meters. (Tristán.) One male. [Hebard Cln.]

Bonnefil Farm, Rio Surubres. Elevation, 700 feet. October 12, 1909. (Calvert; on heliconia stem.) One immature male.

Pozo Azul de Pirris. Elevation, 325-550 feet. August 27, 1927. (Lankester and Rehn; in forest on hill-slope.) One immature male.

In addition to the specimens here recorded I have before me a single male each, previously recorded by me, from Piedras Negras and Cachi, as well as a paratype male from Bugaba, Panama, and other material from Panama, Honduras and Mexico.

Giglio-Tos<sup>29</sup> has used as diagnostic features for species in *Pseudomiopteryx* the shape of the dorsal margin of the facial scutellum and the surface sculpture of the same. The present series of males, which unques-

<sup>29</sup> Das Tierreich, Lief. 50, pp. 253-256, (1927).

tionably represents a single species, has been carefully analyzed for these features, and gives some interesting information as to the constancy of these and other characters. The dorsal margin of the facial scutellum varies from regularly arcuate to decidedly obtuse-angulate, and its surface may be almost plane, low bituberculate, weakly and broadly trisulcate with the sulci parallel or the laterals diverging ventrad, or appreciably but still not strongly trisulcate with the laterals generally diverging ventrad but occasionally parallel (in one). The Chiriqui paratype has the dorsal margin of the scutellum blunt obtuse and the sulcations shallow and parallel. The number of spines on the internal margin of the cephalic femora varies from ten to thirteen (averaging twelve), of the external margin of the cephalic tibiae eight to nine (in two specimens on one limb only) and of the internal margin of the same from seven to nine (averaging eight).

The male series demonstrates there is some variation in size, which is probably entirely individual. Elevation suggests but does not fully explain the smaller wing size of certain males from the higher levels, as the Las Cóncevas ones have as extensive alar appendages as any specimens seen. There is, however, a fair degree of correlation of pronotal proportions with elevation. The specimens from the lower country on the Atlantic side (i. e. below 1000 meters or Cachi) and from Bugaba and Piedras Negras on the Pacific slope, have the pronotum with the shaft somewhat longer and more slender than those from higher levels, in which the pronotum is progressively shorter and with the shaft stouter, even though the individual may be a relatively small one. The accompanying figures (plate 7, figures 6 and 7) show the extreme conditions found in the series. The following measurements (in millimeters) illustrate the extent of size variation found in the series.

	Length of body	Length of pronotum	Greatest width of pronotum	Least width of pronotal shaft	Length of tegmen	Length of cephalic femur
♂						
La Emilia .....	20	3.94	2.18	1	16	4.45
La Florida .....	20.8	4.2	2.1	1.09	17.5	4.78
Cachi .....	19	4.03	2.18	1.21	18.7	4.78
Las Cóncevas .....	19.2	3.94	1.97	1.17	18	4.2
San José .....	18.8	3.61	1.93	1.05	17.2	3.86
Escazú .....	16 <sup>30</sup>	3.52	2.01	1	15.8	4.03
Piedras Negras .....	21.2	4.2	2.26	1.26	18+	4.87
Bugaba, Panama .....	21	4.2	2.18	1.09	16.3 <sup>31</sup>	4.87
♀						
La Emilia .....	20	5.62	3.36	1.59	—	5.79

It is noteworthy that the males in the instar preceding maturity show numerous features which would at once point to their being immature females if the abdominal appendages and the well-developed alar lobes

<sup>30</sup> Abdomen twisted.

<sup>31</sup> Damaged at base, measurement may be too small.

were not incontestable proof of their sex. The ocellar spots are very small and the process bearing the medio-ventral ocellus is very brief and weak, while the cephalic limbs are proportionately more robust than in the adult male, the coxae heavier and with spinulose margins, the femora distinctly heavier, deeper and more strongly spined. The limb conditions are essentially those of the adult female. Apparently the immature stages so completely necessitate a predatory existence, that the male, which has but limited function as an adult, is then endowed with similar powers of food procurement in the sturdy development of the raptorial limbs.

The species is known to range from as far north as Cordoba, Vera Cruz, Mexico, southward to an undetermined point in northern South America. Our knowledge of the genus in Colombia and Venezuela is so inconclusive and unsatisfactory it is not possible at this writing to say exactly how far, in that direction, true *infusata* extends. The latter may prove to be identical with, or but subspecifically separable from Saussure's *bogotensis*,<sup>32</sup> but Columbian material now available is not sufficiently ample from any one locality to demonstrate clearly whether *bogotensis* is a fairly fixed and localized form, or one so variable that the fluctuations seen in Colombian individuals would be referable to a single species.<sup>33</sup> In addition we have two other species described from Colombia by Giglio-Tos,<sup>34</sup> the characters of which are of doubtful value. The species *infusata* was reported from Caracas, Venezuela by Chopard,<sup>35</sup> but without comparison I am unable to say whether this determination is correct. In Costa Rica *infusata* is known to range altitudinally from near sea level (Estrella Valley) to as high as 1400 meters (La Mica and Las Cóncevas).

This strange little mantid passes the day-time hidden away in dark nooks and crannies, apparently being partial to the folds of dead and hanging banana leaves, from which I have secured both sexes. At night the males sally forth with a moth-like flight, and are attracted to lights, indoors as well as those more exposed. I have never encountered adults of the species actively on the move in the day-time, and have captured them generally where conditions have been altered by man. It is, however, just as much a forest insect, but less frequently seen there than in other situations. Picado captured a single individual at La Mica (1400 meters elevation) in a bromeliad (*Vriesia*) growing one and a half meters from the ground, and the above-recorded Palomo specimen was similarly taken by him from a bromeliad.

Available information attests the presence of the species in the adult condition from February (La Mica; Picado) to September (La Emilia).

<sup>32</sup> Mitth. Schweiz. Entom. Gesell., III, p. 228, (1870).

<sup>33</sup> See Hebard, Trans. Amer. Ent. Soc., XLV, pp. 134-135, (1919).

<sup>34</sup> Das Tierreich, Lief. 50, pp. 255-256, (1927).

<sup>35</sup> Ann. Soc. Entom. France, LXXXV, p. 173, (1916).

Immature material shows that it is not always mature by October (Bon-nefil Farm) and the species is probably at least two brooded. The series of immature specimens before me also indicates that two instars may be found at the same time.

## OLIGONICINAE

### MIONYCOIDES,<sup>36</sup> new genus

This genus is a relative of *Pseudomusonia* Werner (= *Mionyx* Saussure 1892, not of Cope 1886),<sup>37</sup> but readily separable by the presence of biseriately arranged tuberculations flanking the median carina of the pronotal shaft, by the presence of an unequally balanced pair of tubercles near the middle of the same shaft, by the entirely serrato-denticulate (♂) to dentate (♀) lateral margins of the pronotum, the distinct and evident juxta-ocular lobes of the occiput, the more evident ventral ocellar peduncle, the broader tegmina of the male with sinuous discoidal sectors, and the broader wings of the same sex. The form is somewhat more robust than in *Pseudomusonia*, but the pronotal surface structure is the chief distinctive feature which will at once enable the student to separate the genus from *Pseudomusonia*, away from which *Mionycoides* appears to be a step toward more extreme conditions of the subfamily Oligonicinae.

*Generic Characters*.—Male adult fully alate, female apterous. Head transverse; in profile with plane of vertex forming obtuse-angle with axis of lower face; occiput transverse, subtruncate, with distinct but rotundato-trigonal juxta-ocular lobes; ocelli in male large, with ventral more elevated than dorsal pair; facial scutellum transverse, narrow, dorsal margin arcuate; eyes prominent, ovoid in lateral aspect. Pronotum elongate, slender, supra-coxal expansion brief, subacute laterad, collar regularly narrowing cephalad to subtruncate cephalic margin; shaft two and one-half times as long as collar; median carina continuous and distinct but fine and low, immediately bordered on each side on both shaft and collar by a row of numer-

<sup>36</sup> In reference to its relationship to *Mionyx* Saussure (= *Pseudomusonia* Werner).

<sup>37</sup> *PSEUDOMUSONIA* Werner

*Mionyx* Saussure, Soc. Entom., VII, p. 122 (1892), [Not of Cope, 1886].—Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 162, 166, (1894).

*Pseudomusonia* Werner, Verh. k. k. Zool.-bot. Gesell. Wien, LIX, p. 78. (1909).

*Eumionyx* Giglio-Tos, Das Tierreich, Lief. 50, pp. 260, 262, (1927).

Genotype.—*Musonia lineiventris* Stål (by designation of Kirby, 1934). No included species were given by Saussure in 1892, and the first citation of included species is by Saussure and Zehntner. Werner's *Pseudomusonia* was proposed without further note for preoccupied *Mionyx*, and *Eumionyx* was similarly erected, apparently without knowledge of Werner's earlier replacement. Of the species which were placed in this genus by Giglio-Tos (vide supra) *rapax* is probably, and *ferus* is definitely referable to *Mionycoides* here described. Saussure and Zehntner's *Mionyx saevus* (Biol. Cent.-Amer., Orth., I, pp. 166, 167, (1894)) has been placed as a synonym of *lineiventris* by Hebard (Trans. Amer. Ent. Soc., XLVIII, p. 334, (1923)) and Chopard's *Mionyx maculosus* (Ann. Soc. Entom. France, LXXX, p. 332, 2 figs., (1911); 1♂, ♀; Nouveau Chantier and St. Laurent du Maroni, French Guiana) may, like *ferus*, prove generically distinct, although intimately related to *Pseudomusonia*.

ously spaced and generally paired tubercles, laterad of which and faintly cephalad of middle of shaft is placed a pair of larger unbalanced tubercles; lateral margins of entire pronotum serrato-denticulate (♂) or with regularly spaced dentations (♀), of two size categories in both sexes. Tegmina of male broad, nebulo-se hyaline, apex rounded costad, obliquely subarcuate suturad; costal field broad in proximal two-fifths of tegmen; discoidal rami distinctly multi-sinuuous in their general direction, the sinuosities influenced by numerous brief cross-veins in connection with the irregular and incomplete intercalated false nervures. Wings of male nebulo-se hyaline, with apex broad, briefly subtruncate. Abdomen bacilliform in both sexes; ultimate tergite (supra-anal plate) of male acute trigonal produced, medio-longitudinally carinate; of female lanceolate trigonal produced, apex acute, carinate as in male. Limbs elongate, slender: cephalic femora faintly upcurved distad; spines only on distal half, tibial claw groove distinctly distad of middle; discoidal spines four in number; internal margin of femora with eleven spines in a formula, reading distad, of  $\text{IIIIIIIIII}$ ; external margin of cephalic tibiae with four spines, the distal the larger and the more proximal distinctly spaced off from the others; internal margin of tibiae with five to seven spines (generally seven), the four distal arranged (reading proximad)  $\text{III}$ , the more proximal one to three always small and closely placed: cephalic metatarsus faintly longer than remaining tarsal articles; caudal metatarsus comprising nearly two-thirds the length of the entire tarsus.

Genotype.—*Mionyx ferus* Saussure and Zehntner.

**Mionycoides rapax** (Saussure and Zehntner).

*Mionyx rapax* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 166, 167, pl. X, figs. 22-25 (as *Musonia rapax* on plate), (1894), [♀ (immature?); Caché (=Cachí), Costa Rica].

There is little question in my mind but that the description of *rapax* is based on an immature female of the next species. However, no material in hand is quite young enough to be fully comparable, and for the present it seems best to let the name stand until the synonymy can be established or separability proved beyond any doubt. If *rapax* is found to be identical with *ferum* the former name has line priority, but *ferum* is based on an adult male individual and *rapax* apparently, from its size, on an immature female specimen.

There is nothing in the original description of *rapax* except size which could in any way be considered a feature specifically to distinguish *rapax* from *ferum*. The length of the body is given as 20 mm., of pronotum as 7, of cephalic femur as 5.5.

**Mionycoides ferum** (Saussure and Zehntner). Plate 7, figures 1-3.

*Mionyx ferus* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 166, 167, pl. X, figs. 15 and 16 (*fera* on plate), (1894), [♂; Volcán de Chiriqui, 2500-4000 feet, Panama].

*Harpagonyx carlottae* Rehn, Proc. U.S. Nat. Mus., XXVII, p. 568, (1904), [♂; San Carlos, Costa Rica].

*Catamusonia minor* Beier, Mitth. Zool. Staatsinst. und Zool. Mus. Hamburg, XLV, p. 14, (1931), [♂, ♀; Hamburg Farm, Las Mercedes, Limón District, Costa Rica].

Estrella Valley. April 15, 1916. (Lankester.) One male.

Vesta Farm, Estrella Valley. Elevation, 200 feet. September 13, 1923. (Rehn; running on ground in heavy lowland forest.) One female.

Hamburg Farm, Rio Reventazón. April 3. (C. W. Dodge.) One female. [M. C. Z.]

La Emilia, Guápiles District. Elevation, 1000 feet. August 18 and 24, 1923. (Rehn; from undergrowth and ground cover in heavy forest.) One adult female, one female in instar preceding maturity.

Carrillo. May, 1903 (♂); August to September, 1903 (♀). (Underwood.) One female, one immature male in instar preceding maturity. [Hebard Cln.]

Juan Viñas. March. (Ex Bruner Cln.) Two females. [Hebard Cln.] Costa Rica (without exact locality). (Lankester.) One male.

My description of this species as the synonymic *Harpagonyx carlottae* was due to inexperience with the oligonychids, a misreading of the number of femoral discoidal spines and the general non-agreement of the male sex of this species with other species referred to *Mionyx* by Saussure and Zehntner in the "Biologia", the most important literature on the subject then available. This dissimilarity has necessitated the creation of the genus *Mionycoides*. The synonymy of *Harpagonyx carlottae* was first correctly established by Giglio-Tos.<sup>38</sup>

The description of *Catamusonia minor* by Beier is definite and exact and fits this species in all details. In generically placing this species he was also led astray by the tibial spination, which is not orthodox for the Oligonichinae, but is even less so for the Thespinae, where *Catamusonia* Giglio-Tos (= *Macromusonia* Hebard, 1923) has been placed. I am not convinced that the true position of *Pseudomusonia*, and the then included species of *Mionycoides*, is where Giglio-Tos has placed them, but this can be determined only by an analytic study of all the genera referred to the subfamily. It is probable these genera form one of the less specialized stocks leading up to the exceedingly aberrant and divergent extremes of the subfamily. At any rate it is easy to understand how Beier was misled, as Giglio-Tos' diagnostic keys are, at least in this connection, not at all convincing. In the present instance I have before me material of the genotypic species of the genera involved and thus can readily determine the true position of the well-described *minor* of Beier.

The descriptions given by Saussure and Zehntner, Rehn, and Beier together present all the salient features of the species.

The perfect adults before me measure (in millimeters) as follows:

<sup>38</sup> Das Tierreich, Lief. 50, p. 263, (1927).

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen	Length of cephalic femur
♂, Estrella Valley ....	30	8.6	1.42	20.7	5.8	6.6
♂, "Costa Rica" .....	31.6	8.8	1.84	20.2	5.8	6.38
♀, Vesta Farm .....	34	11.9	2.64	—	—	9.5
♀, La Emilia .....	34	11.5	2.68	—	—	9
♀, Carrillo .....	33	11.9	2.68	—	—	9.2
♀, Juan Viñas .....	30.5	10.5	2.52	—	—	8
♀, Juan Viñas .....	— <sup>39</sup>	10	2.43	—	—	7.9

These measurements would suggest that at its upper limit of distribution in Costa Rica the species averages slightly smaller than at lower levels. The available series, however, is too small to more than suggest this as a possibility.

It is evident that both sexes exhibit a marked range in color tone. One extreme is represented by the male without exact locality, the immature male from Juan Viñas and the female from La Emilia, as well as the type of *Harpagonyx carlottae*. In this intensive phase the general tone is a deep umber to fuscous brown, the tegmina and distal portion of the wings with numerous scattered, relatively small, pale ochraceous areolae, the limbs also appreciably but not markedly or regularly subannulate with dull ochraceous. In the recessive extreme, which is typically represented by the Vesta Farm and Carrillo females, one from Juan Viñas and the female from Hamburg Farm the base ochraceous-tawny color is unobscured except for a darkening of the median and caudal limbs to cinnamon-brown, with indications of the subannulations of the opposite extreme. The Estrella Valley male has the main body tone of the intensive type, but the tegmina and wings are paler—prout's to mummy brown—with the areolae nearly clear hyaline, larger, more extensive and often connected so that the dark areas are greatly restricted, particularly on the tegmina. In this specimen the limbs are dull ochraceous-buff with distinct prout's brown subannulations on the cephalic coxae and median and caudal limbs.

The home of this active mantis is in heavy forest, where the females at least live on or beneath the undergrowth making up the lower part of this three-storied world. The males probably are attracted to light at night, although none were seen by me in more than four weeks of active collecting during two seasons at Guápiles and in the Estrella Valley. The distribution of the species in Costa Rica is apparently limited to the eastern Tropical Zone, not ascending higher than Juan Viñas,<sup>40</sup> and also not occurring on the Pacific slope as far as known. Outside of that country it is known only from the Volcán de Chiriquí, Panama.

<sup>39</sup> Body too curved to measure accurately.

<sup>40</sup> If *rapax* proves to be the same as *ferum* the range would be extended a few miles up the Reventazón Valley to Cachí. Conditions, however, are very similar.



The dates of capture of Beier's material were June 25 and December 11. From his information and that here recorded it is evident that the species occurs adult from at least as early as March (Juan Viñas) to as late as December (11).

#### THRINACONYX Saussure

*Thrinaconyx* Saussure, Societas Entomol., VII, p. 122, (1892).—Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 162, 178, (1894).

*Costaricella* Sjöstedt, Arkiv för Zoologi, 21 A, no. 32, p. 24, (1930).

Genotype (by selection of Kirby, 1904<sup>41</sup>).—*Thrinaconyx fumosus* Saussure and Zehntner. When originally proposed no included species were given for the genus *Thrinaconyx*, and the type was selected from those species included by Saussure and Zehntner. Sjöstedt's *Costaricella*, as shown under *T. fumosus*, is a synonym of *Thrinaconyx*, the genotype (and sole included species) *C. fasciata* being the immature female condition of *fumosus*.

The highly specialized structure and spination of the cephalic femora and tibiae in this genus indicate marked divergence from related genera and evident adaptation to special habits in securing food.

The very brief key given by Saussure and Zehntner<sup>42</sup> to distinguish the species then placed in the genus is valueless, as it is contradicted by the detailed specific descriptions given below it on the same page. Similarly the key supplied by Giglio-Tos for the same species<sup>43</sup> does not hold for the material before me, although the latter fully agrees with Saussure and Zehntner's detailed original descriptions and figures. The following key presents the more salient differential features of the Costa Rican species now before me:

*Male sex only* (female of *kirschianus* unknown).

1. Size smaller (length of body, 12.5–14.5 mm.; of pronotum, 3.36–3.78; of wing, 12–13.2). Head with occipital line mesad concavely falling below dorsal point of eyes. Pronotum more slender, shaft no broader than average width of collar. Cephalic tibiae more slender.

*fumosus* Saussure and Zehntner

Size larger (length of body, 15.9 mm.; of pronotum, 4.44; of wing, 16).

Head with occipital line mesad subtruncate, not falling below dorsal point of eyes. Pronotum more robust, shaft slightly broader than average width of collar. Cephalic tibiae more robust.

*kirschianus* Saussure and Zehntner

The single specimen of *kirschianus* before me is minus the tegmina, and I am unable to use tegminal venational features or form of the tegmina in the above key, both of which apparently are here of value in specific differentiation.

<sup>41</sup> Synon. Catal. Orth., I, p. 279.

<sup>42</sup> Vide supra, p. 179.

<sup>43</sup> Das Tierreich, Lief. 50, p. 264. (1927).

**Thrinaconyx fumosus** Saussure and Zehntner.

*Thrinaconyx fumosus* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 179, pl. X, figs. 4-10, (1894), [♂; Volcán de Chiriqui, 2000-4000 feet, Panama].—Hebard, Trans. Amer. Ent. Soc., XLVIII, p. 333, [Description of ♀ sex].  
*Costaricella fasciata* Sjöstedt, Arkiv för Zoologi, 21A, no. 32, p. 25, pl. 3, fig. 6, (1930), [♀; Talamanca, Costa Rica].

Vesta Farm, Estrella Valley. Elevation, 200 feet. September 11-13, 1923. (Rehn; running on dead leaves on ground in heavy forest.) One female, one immature female.

La Emilia, Guápiles District. Elevation, 1000 feet. August 15-24, 1923. (Rehn; swept from low foliage in forest or jumping about among dead twigs on ground in same.) One male, two females. September 14, 1927. (Rehn; shaken from dead foliage in heavy forest.) One male.

Carrillo. (W. Schaus.) One male. [U. S. N. M.]

Fifty-two mile post on Atlantic Railroad, near Peralta. August 3, 1927. (Lankester.) One male.

Juan Viñas. Elevation, 3300 feet. June 27, 1909. (Calvert; on coffee plants.) One female.

A careful comparison of Sjöstedt's description of *Costaricella fasciata* with females of this species shows beyond question that his insect is merely the apterous female of *T. fumosus*. The description of this genus is particularly unfortunate, as Hebard seven years previously had described the female in detail from Panamanian material. The immature female from Vesta Farm is virtually topotypic of *Costaricella*, as the Estrella Valley is in the old province of Talamanca, and also is similar in size and condition.

The present series, together with a considerable one from Panama, shows that this strange little mantis is a denizen of the heavy lowland tropical forest region of the Atlantic slope in both Costa Rica and Panama. In the former country its distribution reaches as high as Juan Viñas (3300 feet elevation of collecting station). The preferred habitat is the shade of dense forest, the males hidden in the daytime in low foliage, sometimes the hanging dead type, the females actively hunting over the dead leaves and twigs on the forest floor, when passage is obstructed or when pursued displaying no small jumping ability. This saltatorial propensity is much more broadly developed in the smaller mantids than is generally supposed. Among other genera it is found quite distinctly evident in the desert-dwelling North American amelid genera *Litanentria* and *Yersiniops*.

While the females before me are within the range of measurements given for that sex by Hebard, on the basis of Panamanian material,<sup>44</sup> the males show a more extensive degree of size variation than in males from Panama, those before me measuring (in millimeters) as follows:

<sup>44</sup> Trans. Amer. Ent. Soc., XLVIII, p. 334, (1923).

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen	Length of wing
♂, La Emilia .....	14	3.36	1.09 <sup>45</sup>	11.8	3.8	12
♂, La Emilia .....	14.1	3.78	1.26	11.7	3.7	13.2
♂, Carrillo .....	14.5	3.69	1.26	12.9	3.94	13
♂, Near Peralta .....	13.5	3.78	1.3	12	4.03	13.2

The dorsal margin of the facial scutellum in this species is described by Giglio-Tos as "faisant un angle obtus mais arrondi."<sup>46</sup> The present series show that this margin varies from broadly arcuate to rounded obtuse-angulate, and in both sexes.

The color notes which have been given by Hebard apply equally to the Costa Rican series, except that the tri-annulation of the cephalic tibiae is distinctly evident in all the males except one from La Emilia, in which it is present to a less marked degree.

Outside of Costa Rica and Panama *fumosus* is known only from Gorgona Island, off the west coast of Colombia.<sup>47</sup>

The species has been taken adult in Costa Rica from as early as June to as late as mid-September. It has been taken adult in Panama as early as April 18, and on Gorgona Island, Colombia as late as November. From this it doubtless will be found adult in Costa Rica over a longer period than the present material would indicate.

***Thrinaconyx kirschianus*** Saussure and Zehntner. Plate 7, figures 4 and 5.

*Thrinaconyx kirschianus* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 179, pl. X, fig. 11, (1894), [♂; Colombia].

Navarro. Elevation, 3800-3950 feet. July 24, 1927. (Lankester and Rehn; in heavy hill-slope forest.) One male.

I have carefully analyzed the original description of the species, and the brief comparative one published by Giglio-Tos,<sup>48</sup> and find the present specimen is in full accord with the original as far as its condition permits, but shows more than one point of difference from Giglio-Tos' analysis. However the Navarro specimen lacks the tegmina, which were broken off by foliage in beating, and in consequence, while the wings are not damaged, I am unable to draw upon the tegminal features for entire confirmation of the determination.

The specimen measures (in millimeters): length of body, 15.9; length of pronotum, 4.44; greatest width of pronotum, 1.34; length of wing, 16; length of cephalic femur, 3.78.

<sup>45</sup> In this specimen the supra-coxal lobes are more strongly deflexed than in the others, and in consequence this measurement is unusually small.

<sup>46</sup> Das Tierreich, Lief. 50, p. 264, (1927).

<sup>47</sup> Beier, Ann. and Mag. Nat. Hist., (10) VI, p. 446, (1930).

<sup>48</sup> Das Tierreich, Lief. 50, p. 264, (1927).

It is possible the future may show that while *fumosus* is a species of the rain forest of the lower Atlantic slope, the present form takes its place at higher levels in a forest of other character and with an appreciably different fauna. Navarro and "Colombia" are the sole localities known for the species.

#### OLIGONICELLA Giglio-Tos

*Oligonicella* Giglio-Tos, Bull. Soc. Entom. Ital., XLVI, pp. 190, 192, (1915).

Genotype (by original designation).—*Oligonyx scudderi* Saussure.

This genus comprises six species of Sonoran origin, and as at present known ranges from the southern United States (*scudderi* and *mexicana*) to Colombia (*brunneri*). It is of localized distribution within its range, and is partial to special types of environments. Except for the present record we possess no exact information as to the character or elevation of its habitats south of southern Mexico. In the latter country it is known to occur at elevations from as low as 1000 feet to as high as 8000.

The single individual of this genus known to me from Costa Rica is in imperfect condition and its specific reference is tentative, awaiting the acquisition of additional Costa Rican and other Central American and Mexican material.

*Oligonicella striolata* (Saussure and Zehntner).

*Oligonyx striolata* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 173, pl. IX, figs. 18-22, (1894), [♂; San Geronimo and Dueñas, Guatemala.]

Monte Redondo.<sup>49</sup> April, 1903. (Underwood.) One male. [Hebard Cln.]

This specimen is but tentatively referred to *striolata* and lacks most of the distal section of the abdomen, as well as one cephalic, one median and one caudal limb. I have compared it with a male from Ocotlan, Oaxaca, Mexico,<sup>50</sup> which agrees with the Monte Redondo specimen except that its pronotum is slightly shorter proportionately and its coloration is paler, the irroration of the principal veins of the tegmina and wings being almost lacking and the bases of the cross veins much less infusate than in the Costa Rican specimen, which in these respects fully agrees with the original description and figures. However, Saussure and Zehntner show that Dueñas material has the pattern of the longitudinal veins of the tegmina and wings obsolete, which is essentially what we find in the Ocotlan male.

<sup>49</sup> The locality Monte Redondo is on the south-facing slope of the Candelaria Mountains, almost due south of San José, and across the Alto de Aserri (6700 feet) from the old town of Aserri. The surrounding slopes are steep, very largely planted in coffee, and the general elevation of the finca of Monte Redondo is 4000 feet. In 1927 I spent two nights there, as the guest of Don Roberto Zeledón, when on a trip to Pozo Azul de Pirris with Mr. Lankester.

<sup>50</sup> March 30, 1922; (J. J. White); [Hebard Cln.].

The very narrow tegmina and wings are distinctive features of *striolata*, and in this respect the two specimens before me have tegmina even narrower proportionately than in the type. In addition the tegmina are more distinctly rotundato-acute at the apex than the original figures of *striolata* would indicate. The pronotum is shorter proportionately in both specimens than in the material measured by the describers, but the variation found by Hebard in the pronotal length in the related *Oligonicella mexicana* and *tessellata*<sup>51</sup> would virtually cover the variation shown by the measurements (in millimeters) here given.

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen	Length of caudal femur
♂, type, ex Saussure & Zehntner .....	31.5	6.3	—	21.5	4.5	6
♂, Ocotlan, Oaxaca ....	27	4.45	1.8	19.8	4.03	4.62
♂, Monte Redondo, Costa Rico .....	—	4.87	1.72	17.2	3.69	4.45

The Ocotlan male has the shaft of the pronotum proportionately shorter than in the Monte Redondo individual, the ratio of collar to shaft being as 48 to 55 in the former and 48 to 65 in the latter.

Until contrary evidence is available the Monte Redondo specimen can with propriety be referred to *striolata*. No close affinity is shown to the South American *O. brunneri* (Saussure),<sup>52</sup> which has a number of peculiarities of the limbs and alar organs.

#### OLIGONYX Saussure

*Oligonyx* Saussure, Mitth. Schw. Entom. Gesell., III, pp. 58, 71, (1869). (*Oligonix* by error on page 71.)

*Spanionyx* Saussure, Societas Entom., VII, p. 122, (1892). (Genotype by selection of Rehn (February, 1904), *Spanionyx bidens* Saussure and Zehntner.)

*Harpagonyx* Saussure, Societas Entom., VII, p. 122, (1892). (Genotype by selection of Rehn (February, 1904), *Harpagonyx gryps* Saussure and Zehntner.)

Genotype (by indication of Giglio-Tos, 1915,<sup>53</sup>).—*Oligonyx bicornis* Saussure.

The synonymy of *Spanionyx* and *Harpagonyx* was correctly established by Giglio-Tos in 1915. The rather unusual situation of two of Saussure's genera being synonymized under one of his earlier ones is due to the fact that in 1892 to 1894, when the later genera were described and invested with species, the generic name *Oligonyx* was utilized for species now considered representative of a distinct genus from those originally included in *Oligonyx*. Unfortunately at that time Saussure and Zehntner failed to

<sup>51</sup> Trans. Amer. Entom. Soc., XLVII, pp. 184-185, (1923).

<sup>52</sup> Mém. Hist. Nat. Mex., IV, (Mant. Amér.), p. 119, (1871), [♂; Porto Cabello, Venezuela (in error given as Colombia)].

<sup>53</sup> Bull. Soc. Entom. Ital., XLVI, p. 192, (1915).

associate sexes of the same species, referring males to *Harpagonyx* and females to *Spanionyx*. The respective genotypes of *Harpagonyx* and *Oligonyx* represent sexes of the same species, and that of *Spanionyx* is the female sex of a closely related form.

**Oligonyx dohrnianus** (Saussure and Zehntner).

*Oligonyx dohrnianus* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 176, (1894), [♂; Guatemala].

*Spanionyx bidens* Rehn, Proc. U.S. Nat. Mus., XXVII, p. 569, (1904), [♀; Turrialba]. (Of Saussure and Zehntner, 1894 ?)

Juan Viñas. Elevation, 3500 feet. 1909. (Schaus and Barnes.) One male. [U. S. N. M.]

There is every probability the female recorded by me as *bidens* represents the previously unrecognized female of *dohrnianus*. Whether this is identical with true *Spanionyx bidens*, based on the female sex, remains to be determined. If this should prove to be the case, the description of *Oligonyx dohrnianus* has one page precedence over *Spanionyx bidens* Saussure and Zehntner,<sup>54</sup> and in consequence *dohrnianus* would hold for the species. Without sufficient female material to ascertain the correct relationship of *Spanionyx bidens* I am unable to do more than suggest that *bidens* may be the female of *dohrnianus*, although the former is said to have the supra-anal plate elongate lanceolate, while in the latter it is triangular and subequal. In the related *Oligonyx bicornis* (Saussure), from Mexico, the proportions of the supra-anal plate (ultimate tergite) are the same in the two sexes.

The Juan Viñas male has been compared with a male from Morales, Guatemala,<sup>55</sup> and another of the same sex from San Pedro Sula, Honduras,<sup>56</sup> and all three are referable to the same species, which, however, shows considerable variation in size and in the depth of the general infusation, particularly of the principal veins.

In size the three specimens mentioned above measure (in millimeters) as follows:

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Length of wing	Length of cephalic femur
♂, Morales, Guatemala .	37.2	10 .	1.51	17.9	18	7
♂, San Pedro Sula, Honduras .....	44.4	11	1.68	22	22.5	7.8
♂, Juan Viñas, Costa Rica .....	— <sup>57</sup>	10.7	1.51	20.5	22.5	7.1

<sup>54</sup> Biol. Cent.-Amer., Orth., I, p. 177, pl. X, figs. 1-3, (1894), [♀; Ruatan Island, Honduras].

<sup>55</sup> November, 1931; (J. J. White); [Hebard Cln.].

<sup>56</sup> March 8, 1922; (José Lienhard).

<sup>57</sup> Abdomen damaged.

From the exact localities here given *dohrnianus* is seen to be a species of the eastern tropical section of Central America, the highest locality from which it is definitely known being Juan Viñas, at an elevation of 3500 feet.

#### THESPROTIA Stål

*Thesprotia* Stål, Bihang till K. Svenska Vet. Akad. Handl., IV, no. 10, pp. 45, 67.

Genotype (by monotypy).—*Thespis filiformis* Saussure (= *Mantis infumata* Serville).

To the genus *Thesprotia*, which is characterized by the most unusual specialization of the form and spination of the cephalic tibiae, have been referred approximately a dozen species, a number of which are known only from a single sex. The genus is greatly in need of careful and detailed study, as five of the species which were described by Giglio-Tos are known only from unpardonably brief and inadequate descriptions, in all cases from single sexes and unaccompanied by figures. A single species (*T. graminis*) is native to the southeastern United States, where it occurs in pine-land ground cover, while all the others previously known are South American, none definitely recorded nearer Costa Rica than the Guianas. The occurrence of a species of distinctive character in the area under consideration is of exceptional interest.

***Thesprotia insolita***, new species. Plate 7, figures 8-11.

This species is the first of the genus to be reported from Central America. Comparison of it with the various species which have been described from South America has been difficult, either because the female sex of them alone is known, or the names have been based solely on unjustifiable brief and entirely insufficient diagnoses, often without mention of features which are of real value in the male sex. It is not possible to compare the species with Giglio-Tos' *T. maculata* and *gigas*,<sup>58</sup> known only by the female sex from "Brazil", but both of these are far larger than the females of species which are known from both sexes, and in which the male is larger than in *insolita*, such as *infumata* and *fuscipennis*. *Insolita* is a distinctly smaller species than either *infumata* (Serville),<sup>59</sup> *subhyalina* (Saussure)<sup>60</sup> or *fuscipennis* Saussure and Zehntner.<sup>61</sup> and from the latter it also differs in the more delicate form and absence of general deep infuscation. The new species is larger than *brevis* and *simplex* Giglio-Tos,<sup>62</sup> and has the pronotum proportionately longer than in *pellucida*<sup>63</sup> of the

<sup>58</sup> Bull. Soc. Entom. Ital., XLVI, p. 196, (1915).

<sup>59</sup> Hist. Nat. Ins., Orth., p. 173, (1839), [♂; Brazil].

<sup>60</sup> Mitth. Schw. Entom. Gesell., III, p. 239, (1870), [♂; Brazil].

<sup>61</sup> Biol. Cent.-Amer., Orth., I, p. 171, (1894), [♂, ♀; Rio de Janeiro, Brazil].

<sup>62</sup> *Brevis*, Bull. Soc. Entom. Ital., XLVI, p. 196, (1915), [♂; Puerto Casado, Paraguay]. *Simplex*, Idem, p. 197, [♂; Brazil].

<sup>63</sup> Bull. Soc. Entom. Ital., XLVI, p. 197, (1915), [♂; Brazil].

same author. The presence of a marked spine on the ventro-lateral margin of the cephalic tibiae at once distinguishes *insolita* from *brasiliensis* Chapard.

From *filum* (Lichtenstein),<sup>64</sup> of the Guianas, the somewhat wider collar of the pronotum, the distinctly though finely spinulose lateral margins of the pronotum and the more elongate limbs will serve to separate *insolita*, while from the North American *T. graminis* (Scudder)<sup>65</sup> it can be distinguished by its smaller size, more delicate build, wider collar of the pronotum and more slender but proportionately no longer limbs.

*Type*.—♂; La Fortuna, between Cervantes and Pacayas, southeastern slopes of the Volcán de Irazú, Costa Rica. Elevation, 1430 meters. March, 1906. (Pablo Billeley.) [Academy of Natural Sciences of Philadelphia, Type no. 5517.]

Size medium; form elongate and exceedingly slender, as usual in genus.

Head with greatest depth contained one and one-sixth times in breadth across eyes (as 43 to 50); occipital line subconcave, dropping mesad to level of dorsal point of eyes, compressed, juxta-ocular lobes marked but broad and rectangular in outline; supra-ocular portion of vertex transversely concave;<sup>66</sup> ocelli large, placed in a low triangle; facial scutellum strongly transverse, very narrow laterad, i. e. ventrad of the antennal scrobes, median infra-ocular section circularly impresso-excavate, transverse carination of median section arcuate dorsad, thence ventrad on median line is a weak, very low carinula: eyes in profile elongate ovoid, the greatest width at ventral third and contained twice in length of eye, internal margins of eyes, as seen in cephalic aspect, concavely convergent ventrad. Antennae slightly damaged at tips, as far as preserved extending slightly caudad of caudal margin of pronotum, articles distad of the first six increasingly elongate moniliform, four, five and six very short, bead-like, throughout sparsely but distinctly setulose.

Pronotum of the elongate type usual in the genus, supra-coxal expansion little marked, the greatest width there no greater than width of shaft at caudal third, length of collar contained 3.4 times in length of shaft; cephalic margin distinctly but narrowly truncate, very narrowly rounding to the nearly subparallel but faintly diverging lateral margins of the collar, which with those of the shaft are finely and rather closely denticulate, the shaft margins, after very weakly converging caudad of the little-marked supra-coxal expansion, very faintly expand and are narrowly sublamellate to the caudal third of shaft; caudal margin transversely weak bisinuate: a delicate medio-longitudinal carinula is present on the shaft, continued as an even more subtle indication on the collar, which also for three-fourths of its length has a pair of intermarginal groove-like sulci, which give to the shaft for most of its length a roughly quadricarinate appearance.

<sup>64</sup> "Cat. Auction. Hamburgi, III, p. 81, (1796)." Unable to consult the excessively rare publication containing the first reference, I have examined Lichtenstein's important second reference, which is accompanied by a figure (Trans. Linn. Soc. London, VI, p. 19, pl. 2, fig. 2, (1802), [♀; Surinam]).

<sup>65</sup> Proc. Boston Soc. Nat. Hist., XIX, p. 90, (1877), [♂; Fort Reed, Florida].

<sup>66</sup> This condition is doubtless exaggerated by some shrivelling of the type specimen.



Tegmina reaching to base of fourth abdominal tergite: marginal field of medium width, its venation divided by a longitudinal adventitious vein into a double series of rectangulate to irregular areolations; cross-veins of median and distal sections of discoidal field of tegmina with their portions immediately adjacent to the principal veins appreciably but not excessively incrassate. Wings when extended caudad reaching the base of the fifth tergite; incrassation of cross-veins, as found in tegmina, indicated solely in distal half of wing.

Abdomen of the elongate, bacilliform type usual in the genus, tergites and sternites, except at apex of abdomen, elongate; dorsal surface bearing a fine but distinct and continuous medio-longitudinal carinula, penultimate and antepenultimate tergites short, transverse, quadrate, distal margins transverse truncate except for a weak and shallow median concave emargination; ultimate tergite (supra-anal plate) very elongate, acute lanceolate, greatest proximal width contained two and one-third times in greatest length of same (as 22 to 49), lateral margins regularly straight convergent to the narrowly rounded tip, which is not at all decurved, in transverse section biconcavely tectate, the usual median carinula forming a pronounced ridge, apex of ultimate tergite surpassing apices of styles of ultimate sternite by slightly more than one-third length of tergite; cerci one and two-thirds times as long as ultimate tergite, except for several proximal articles all are elongate moniliform, distal one acute. Ultimate sternite (subgenital plate) slightly transverse, distal margin arcuate except for the styler socket and an intervening shallow rectangulate emargination; styles simple, tapering, blunt acute, in length equal to half that of ultimate sternite.

Cephalic limbs as usual in genus but exceedingly slender; coxae when extended caudad failing to reach caudal margin of pronotum by a distance equal to two-thirds length of pronotal collar, median constriction of coxae even but marked: femora subequal to the coxae in length, straight except for a gentle upcurve distad, total spination occupying only distal third of femur; discoidal spines three, the more proximal of these two-thirds length of other two, which are subequal; external margin with its single spine placed nearly opposite the longest of the internal series; internal margin with five to six spines, proximal very short, next very long, erect, third, fourth, fifth and sixth alternately sized, short and medium in length, the fifth spine absent on one limb: cephalic tibiae very short, of the highly specialized type peculiar to the genus, apical claw nearly as long as the remainder of the tibia and but little arcuate, its apex (when the limb is flexed) falling just short of the base of the second discoidal spine; external margin with a single adpressed spine; dorsal spine large, two-thirds the size of and similar in arcuation to the distal claw; external face with its spine of the apical group straight, three-fourths the length of and inserted immediately ventrad of the dorsal spine; ventro-external margin unspined: tarsi missing. Median limbs elongate and slender, as usual in genus; caudal limbs missing.

General base color ochraceous-buff, overlaid with clouding, vermiculations and punctations of prout's brown to bister. Head basically light ochraceous-buff, eyes longitudinally lineate with six cloud bars of mummy brown; occiput similarly weak multilineate, clypeus strongly bilineate with same; frontal scutellum largely and bases of ocelli encircled with bister;

antennae nearly uniform dresden brown. Pronotum clouded and punctate with darker, generally in longitudinal disposition. Abdomen as a whole nearer dresden brown proximad. Limbs largely punctate with dark; cephalic femora medio-longitudinally lineate on internal face with same; internal face of trochanter with a marked elliptical mummy brown ocellate spot, a less definite one present on the adjacent distal extremity of the coxa; external face of distal extremity of median tibiae briefly medio-longitudinally lineate with mummy brown. Tegmina and wings ochraceo-hyaline, principal vein except proximad pencilled with buckthorn to mummy brown, incrassate portions of cross-veins similarly colored, intercalated longitudinal veins pale.

Length of body, 40.6 mm.; greatest width of head, 2.1; length of pronotum, 11.9; greatest width of pronotum, 1.17; length of shaft of pronotum, 9.21; length of tegmen, 20; length of wing, 20.2; length of cephalic femur, 7.9.

The type of this most interesting species is unique. The specimen has at one time been in a wet preservative or else crumpled when fresh or moist, so that the alar appendages are badly twisted. The right cephalic limb lacks both tibia and tarsus, the left lacks the tarsus and the caudal limbs are missing. The distinctive characters of the species are, however, clearly evident.

The type locality is near the little town of Cervantes through which I passed in 1923 en route to Pacayas, higher on the slopes of Irazú. The surrounding slopes at this elevation had then largely been cleared for pasture, but numerous thickets doubtless yet provided refuge for many forms of the original animal life. Just how much change had taken place between 1906 and 1923 I cannot say, but the systematic denudation of the entire south slope of the volcano had been under way a number of years, and by 1923 forest cover had been greatly restricted below seven thousand feet elevation. In my own field work I have not encountered the genus *Thesprotia* in Costa Rica.

#### POGONOGASTER Rehn

*Pogonogaster* Rehn, Trans. Amer. Entom. Soc., XLIV, p. 326, pl. XVIII, figs. 5 and 6, XX, fig. 1, (1918).

Genotype (by original designation).—*P. tristani* Rehn.

This most unusual mantid, with the related genus *Carrikerella* Hebard, occupies an anomalous position in the Oligonicinae, due to the foliaceous lobing of the abdomen of the female (the sole sex known in both genera) and the structure of the elongate pronotum. Its whole form, as well as coloration, is of protective character and admirably serves in this respect. A second species of the genus is known from Colombia,<sup>67</sup> where it apparently occurs in the same life zone as does *P. tristani*.

<sup>67</sup> *P. latens* Hebard, Trans. Amer. Entom. Soc., XLV, p. 136, pl. XVIII, figs. 6-7, (1919), [♀; Rio Aguatal, Cauca, Colombia].

***Pogonogaster tristani* Rehn.**

*Pogonogaster tristani* Rehn, Trans. Amer. Entom. Soc., XLIV, p. 327, Pl. XVIII, figs. 5 and 6, XX, fig. 1, (1918), [♀; La Palma, Costa Rica].

I have seen no material of this strange mantid other than the type. In both 1923 and 1927 I visited La Palma, in company with Prof. Tristán, and one of the special incentives was to secure additional information on this bizarre genus. Prof. Tristán took me to the exact environment where the type was taken in May, 1906, but prolonged and intensive search failed to produce any *Pogonogaster*. However, some years before one of Prof. Tristán's students secured an additional specimen, the present location of which is not known to me.

La Palma is situated at 5000 feet elevation on the pass between the western side of Irazú and the Zurqui shoulder of the volcano of Barba. This pass is traversed by the old cart road over which for years freight was carried from the now abandoned terminal of the "Linea Vieja" railroad at Carrillo to the capital city San José. La Palma consists of a small group of goat and cattle ranches, with their meadows or "potreros" carved out of the moisture-saturated subtropical cloud forest, which on all the undisturbed slopes still solidly mantles the entire pass. The northeast trade-wind for most of the year steadily drives endless masses of moisture-laden vapor through the La Palma pass, a long banner of cloud generally extending southwestward for some distance over the warmer stretches of the Meseta Central, until sunshine and radiation completely evaporate the trade-wind's plume. At La Palma during the wet season sunshiny days are the exception, a fog blanket being the more usual condition and rain or drizzle at most but a few hours off. In consequence the forest trees are buried under a world of epiphytic vegetation of varied character, bromeliads, creepers, ferns and mosses, until the bark is completely hidden and the tree outline gouty and distorted by its living jacket. Even fence posts are burdened with small bromeliads, such as *Tillandsia*, and other epiphytes, while telegraph wires are bedecked with tufts and small trailers. The home of *Pogonogaster* is in the dripping epiphytic blanket on the trunks of forest trees, where with its multilobed abdomen, its gnarled stick-like pronotum and limbs, and its dull yellow-green coloration, the resemblance to its surroundings is so complete that motion alone may be necessary to disassociate it ocularly from the plant background.

It is probable *Pogonogaster* will be found more widely distributed in the subtropical cloud forest of Costa Rica, when our knowledge of that interesting but little studied region is more complete.

**CARRIKERELLA** Hebard

*Carrikerella* Hebard, Trans. Amer. Entom. Soc., XLVII, p. 157, pl. IX, figs. 24, 25 and 26, (1921).

Genotype (by original designation).—*C. ceratophora* Hebard.

This strange genus, which is more nearly related to *Pogonogaster* than to any other, was previously known only from the type species, described from Andagoya, Antioquia, Colombia.<sup>68</sup> This locality and that from which *C. empusa* is here described, are in Tropical lower level rain-forest country of similar character, while the related genus *Pogonogaster* is known only from Subtropical cloud-forest areas. The male sex of *Carrikerella* is unknown.

***Carrikerella empusa***,<sup>69</sup> new species. Plate 7, figures 12 and 13; plate 8, figure 1.

Differing from *C. ceratophora* Hebard, the genotype, in the head having the juxta-ocular protuberances more marked, their mesal bounding sulcations much more sharply cut ventrad toward the antennal bases, the frontal process more horizontal in trend and not distinctly ascending distad, the apex of this process shallowly concave and not sharply bifurcate; in the pronotum being proportionately more elongate, less strongly sinuate in form as seen in profile, the surface of the collar with the second dorsal protuberance low and much less pronounced, the paired nodes at the caudal margin lower and more broadly rounded; in the cephalic limbs being proportionately longer. Unfortunately the unique female type lacks the abdomen and all the median and caudal limbs except one of the first mentioned pair. The differential characters of the head, pronotum and cephalic limbs, however, are sufficiently pronounced to permit the ready recognition of the species.

*Type*.—♀; Peralta, Costa Rica, March 26, 1910. (P. P. Calvert.) [Academy of Natural Sciences of Philadelphia, Type no. 5538.]

Size somewhat larger than *S. ceratophora*; form in general similar but more elongate; surface as a whole less rugulose.

Head distinctly broader across the eyes than median depth (as 75 to 60); occipital line as seen in cephalic aspect with median three-fifths of width, between well impressed vertical sulci, nearly straight transverse, juxta-ocular protuberances marked, roundly elevated, the sulci defining them mesad continuing ventrad across the sides of the vertex to below the level of the frontal production, broader and less narrowly sulcate ventrad; frontal production in profile projecting cephalad at a right angle to the vertical axis of the head, its length equal to two-thirds the depth of the head (as 40 to 60), seen in dorsal aspect the production is subdepressed, proximad being broader than deep, finely carinate medio-longitudinally, lateral margins faintly constricted mesad, distal extremity concavely emarginate, lateral angles narrowly rounded; facial shield relatively small,

<sup>68</sup> Vide supra.

<sup>69</sup> From the superficial resemblances of species of the genus to members of the very different Old World genus *Empusa*.

transverse, dorsal margin rectangulate with immediate angle subtruncate, ventral margin concave, lateral margins vertical, surface with pronounced median vertical sublamellate carina; ocelli very small, placed in a broad triangle; eyes moderately prominent, more definitely globose ventrad than dorsad, in profile ovoid in outline. Antennae very short, filiform.

Pronotum elongate, slender, in profile weakly but appreciably bisinuate, ascending cephalad from supra-coxal expansion, the shaft moderately convex dorsad to near the caudal extremity, to which it then again ascends: seen in dorsal aspect the greatest width across the supra-coxal expansion is contained four and three-fourths times in the pronotal length, the least width of the shaft (i. e. median) slightly less than half that across the expansion (as 30 to 64), the greatest width caudad being seven-tenths that across the expansion; collar with lateral margins regularly subconcavely converging cephalad from point of greatest width to the rather narrow, truncate-arcuate cephalic extremity, the angles of the lateral margins at greatest supra-coxal width distinct and marked, yet obtuse, the lateral margins of the shaft thence caudad subconcavely converging caudad, rather less sharply than cephalad, to the subparallel median third, thence faintly diverging caudad, the caudal margin subconcavely truncate, the lateral margins rather regularly biserially spinulose throughout, the major category more evident cephalad: surface of collar immediately caudad of the cephalic margin with a low transverse arcuate inflation, followed caudad by a sharp, transverse, equally arcuate impression, which caudad is sharply bordered by a median, elevated, conical protuberance, caudad of which to the typical sulcus no marked elevation is indicated but instead a low broad arcuate swelling, bearing caudad a medio-longitudinal sulcation, traversed on the median line by a fine carina, which can be traced cephalad nearly to the cephalic margin of the pronotum; surface of shaft with a decided, elevated, continuous medio-longitudinal carina, which caudad passes between the paired boss-like protuberances at the caudal margin. Mesonotum and metanotum each elongate, narrow cephalad, moderately widening caudad, both with a decided medio-longitudinal carina, which at each caudal margin is elevated into a moderately rostrate process, more decided on the metanotum; caudo-lateral areas of each showing weakly produced alar vestiges, of the character found in numerous non-alate females of species with alate males.

Abdomen missing.

Cephalic limbs quite elongate, slender, basically as in *C. ceratophora* but longer: cephalic coxae when extended caudad reaching to caudal margin of pronotum, trigonal in section but subcompressed, both cephalic (i. e. normally ventral) margins carinate and spinulose-denticulate, the distal extremity of the internal with its produced lamellation rectangulate with the immediate angle rounded: cephalic femora of the elongate, subarcuate type seen in *C. ceratophora*; ventro-lateral margin with the first (proximal), third and fourth spines subequal in length, the second shorter and the fifth (distal) quite small; ventro-internal margin with nine spines, their relation size reading distad being  $I\overline{II}II\overline{II}I$ , the second longer than any other or any of the three discoidal spines, the seventh is quite minute, while the proximal four are closely placed: cephalic tibiae with apical claw not exceeding two-fifths the femoral length, of the type characteristic of the

subfamily and more specifically of the genus; ventro-external margin with a single heavy spine placed immediately ventrad of metatarsal insertion; ventro-internal margin proximad with three to four short, distally hooked spines, increasing in length distad, and a single, very large, straight, obliquely directed spine, which in bulk is the greatest on these limbs; disto-dorsal spines large, prominent, arcuate like the apical claw, internal distal claw similar to disto-dorsal but much smaller: cephalic tarsi when extended proximad (in normal limb position) failing to reach to the trochanter; metatarsus comprising slightly more than half the total tarsal length. Median limbs elongate, slender; median femora appreciably inflated in proximal fourth; median metatarsus nearly twice as long as remaining tarsal articles. Caudal limbs missing.

General ground color light ochraceous-buff, overlaid with a clouded and usually indefinite pattern of cinnamon-brown to mummy brown. Head with process and occiput sprinkled with dots of darker color, the clypeus and ocellar area evenly maculate and fine lineate with the same; antennae annulate with darker; eyes tawny-olive. Pronotum dorsad symmetrically marked with the two shades of brown, the cinnamon-brown more as a wash, the mummy brown as a definite bilineate (cephalad) or transversely clouded pattern (mesad and caudad), the latter broken into several areas by transverse and longitudinal pale areas, the cephalic portion of the pronotum with the lighter areas stippled with mummy brown: mesonotum and metanotum washed with cinnamon-brown to ferruginous, overlaid by a pair of longitudinal lines of mummy brown, the alar rudiments stippled with mummy brown. Cephalic limbs colored much as the pronotum, the sole pronounced features being a pair of mummy brown blotches mesad on the internal face of the femora and the extent to which the extremity of the metatarsus and the remainder of the tarsi are ventrad solidly mummy brown; tips of all spines fuscous, most of them similarly marked at base.

Greatest width of head, 3.04 mm.; length of cephalic process, 1.59; length of pronotum, 12.7; greatest (supra-coxal) width of pronotum, 2.68; length of cephalic coxa, 8.40; length of cephalic femur, 9.49.

The incomplete state of the unique type prevents me from supplying the body length, but it is evident that *empusa* is a larger species than *C. ceratophora*. Until additional material is available we can merely speculate as to the abdominal details.

#### LITURGOUSINAE

#### LITURGOUSA Saussure

*Liturgousa* Saussure, Mitt. Schw. Entom. Gesell., III, pp. 55, 62. (1869).

*Liturgusa* Gerstaecker, Mitt. Naturw. Ver. Neu-Vorpomm. u. Rügen, Greifswald, XX, p. 52, (1889). (Emendation only.)

Genotype (by selection of Kirby, 1904).—*L. cayennensis* Saussure.<sup>70</sup>

This genus is composed of six or eight rather closely related and taxonomically difficult tropical American species. The exact number of forms

<sup>70</sup> Giglio-Tos (Das Tierreich, Lief. 50, p. 292, (1927)), erroneously gives *annulipes* as the genotype. Kirby's fixation is the first, and, being made on one of the two originally included species, must be followed.

in the genus can definitely be determined only after a full and careful study of more ample South American material, particularly from Brazil. Giglio-Tos, in his revision of the Mantidae,<sup>71</sup> unfortunately has made the situation worse by hastily jumbled synonymy and a rather liberal description of new forms, without thorough analysis of those previously described. I have before me at this writing representatives of all the described species of the genus, except Giglio-Tos' *charpentieri* and *parva*, both from "Brazil", which I do not know. Elsewhere I am discussing at greater length his erroneous treatment of Gerstaecker's *lichenalis* and *nubeculosa*, the types of both of which are now before me. Giglio's Tos's *peruviana* is clearly a synonym of the latter, while *lichenalis* has no close relationship with *annulipes* (Serville), of which he considered it a synonym.

The key to the species of the genus given by Giglio-Tos is of no value, as it stresses color features of no basic importance, and in addition misstates the features of certain species, as the types demonstrate. It should, therefore, be ignored by future students, leading as it will to entirely erroneous associations.

The area of distribution of *Liturgousa* extends from southern Mexico (San Rafael, Vera Cruz) and northern Yucatan (Tenax) to at least as far south as Amazonia, and probably beyond an undetermined distance in Brazil, Peru, and Bolivia. Little is known of the vertical distribution of the genus, other than it appears to be limited to tropical lowland areas.

#### *Key to Costa Rican Species of Liturgousa*

Limbs more slender and elongate, particularly the femora. Caudal metatarsus in both sexes very distinctly longer than the other tarsal articles together. Pronotum in both sexes narrower, the greatest supra-coxal width in the female contained three and one-half times in greatest pronotal length. (Eastern Costa Rica.) ..... *annulipes* (Serville)

Limbs more robust and less attenuate, particularly the femora. Caudal metatarsus but slightly, if at all, longer than the other tarsal articles together. Pronotum in both sexes broader and heavier, the greatest supra-coxal width in the female contained two and three-fifths in the greatest pronotal length. (Western Costa Rica.) ..... *maya* Saussure and Zehntner

Incertae sedis: *L. atricoxata* Beier.

The last-mentioned species is discussed on a subsequent page.

***Liturgousa annulipes*** (Serville). Plate 8, figure 4.

*Mantis annulipes* Serville, Hist. Nat. Ins., Orth., p. 199, (1839), [♀: Brazil; Cayenne].

Hamburg Farm, lower Rio Reventazón. April 2. (C. W. Dodge.) One male, two females, one immature female. [M. C. Z.]

La Emilia, Guapiles District. Elevation, 1000 feet. September 15, 1927. (Rehn; in dense second-growth forest.) One female.

<sup>71</sup> Das Tierreich, Lief. 50, pp. 292-295, (1927).

"Costa Rica."<sup>72</sup> One male, one female, one immature female. [Hebard Cln.]

I have compared the above listed specimens with two Guianan females of the species; a female, in the Hebard Collection, from Nouveau Chantier, French Guiana, which had been determined and reported by Chopard, and another of the same sex from Bartica, British Guiana (March 19, 1913; (H. S. Parish)), in the Academy series.

The more slender pronotum and more slender limbs, with proportionately much longer caudal metatarsi, will at once distinguish *annulipes* from *maya*.

In size the available series of *annulipes* shows but little individual variation. The color pattern, as in the other species of the genus, shows a considerable range in the emphasis of the darker arabesque-like pattern on the pronotum, and the exact grouping of the tegminal fuscous clouds. In the male sex the narrow marginal field of the tegmina may be greenish or buffy or pale turquoise green, and with or without scattered fuscous maculations. In the female this field is duller in base color and in available material (four males, six females), always with some clouding. The limbs are in all cases annulate, as in *maya*, even in the immature condition.

The species ranges from at least as far north as eastern Costa Rica and Panama,<sup>73</sup> south and east across northern South America to French Guiana, and probably into Brazil. I have no information regarding the southern limits of its distribution in northwestern South America. In Costa Rica it occurs, as far as definitely known, only in the eastern lowland forest and not higher than one thousand feet above the sea. It has been taken adult in April and September in Costa Rica, and June and July in the Canal Zone, so its seasonal range is from at least April to September.

<sup>72</sup> The male was probably collected at Carrillo by Underwood. The adult and immature female are labelled "Ujarrás de Térraba; September 10, 1907; (M. A. Carriker, Jr)." I am convinced that these individuals, as well as others so labelled, and on which I have commented elsewhere, did not come from this high mountain, cloud forest locality (see Carriker, *Annals Carnegie Mus.* VI, pp. 356-357, 367, (1910)), but were from the low Talamancan country to the eastward, and inadvertently confused while in the possession of Professor Bruner, from whom this material came to Mr. Hebard. These specimens then were not labelled, but were associated under a rough label from which the data now on them was drawn. Mr. Carriker spent two weeks at Ujarrás de Térraba, and under the exceedingly difficult conditions (see his account above mentioned) at this rain-soaked locality (elevation 7000 to 8000 feet) probably collected few insects, as his work was basically ornithological. All the species of Orthoptera labelled as from Ujarrás are lowland Atlantic slope forms, and in no case represent the distinctive subtropical cloud forest fauna which would be encountered at Ujarrás de Térraba.

<sup>73</sup> I have before me two adult males and one immature female taken on Barro Colorado Island, Canal Zone, Panama, June 24, July 13 (immature) and 20, 1924, by Nathan Banks, and from the collection of the Museum of Comparative Zoölogy.



The La Emilia specimen was taken running up and down the heavily moss and lichen covered trunk of a gavilan tree (*Pentaclethra filamentosa*) in dense second-growth forest. It was extremely active and difficult to capture, the markedly depressed form and the procryptic coloration making it exceedingly difficult for one's eyes to follow the crab-like scuttlings around the tree trunk.

**Liturgousa maya** Saussure and Zehntner. Plate 8, figure 5.

[*Liturgousa cayennensis*] variety *maya* Saussure and Zehntner, Biol. Centr.-Amer., Orth., I, p. 160, (1894), [Presumably ♂ and ♀: Teapa, Tabasco, Mexico; Temax, north Yucatan; Zapote, "Guatemala" (correctly western Honduras)].  
*Liturgousa cayennensis* Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 337, (1923), [Costa Rica].

Pozo Azul de Pirris. Elevation, 525-550 feet. (Underwood.) One male. [Hebard Cln.] August 21, 1927. (Lankester and Rehn.) One immature individual.

Between Rio Colorado and Sabanillas, Cerro de Bustamente. Elevation, 1500-3940 feet. August 25, 1927. (Lankester and Rehn; on tree trunk.) One male.

Surubres, near San Mateo. Elevation, 250 meters. January, 1906. (P. Biolley.) One female.

Cangrejal de Aserri. Elevation, 800 meters. April, 1906. (P. Biolley.) One female.

"Costa Rica." (Underwood.) One male, one female. [Hebard Cln.]

There has been considerable confusion as to the relationship of *cayennensis* Saussure and *maya*, which latter was described originally as a variety of the former, almost entirely on color features. There has been a general failure to appreciate the very real differences which separate *maya* from *cayennensis*, although recently Giglio-Tos<sup>74</sup> has emphasized some of them. The difficulty seems to have been that, influenced by Saussure and Zehntner, most workers endeavored to recognize both *cayennensis* and *maya* in Central American material, when in reality these authors had from that territory merely variations in color of a single species, which they erroneously associated with *cayennensis*, a distinct entity not known to me from nearer Central America than the Guianas.

True *cayennensis*<sup>75</sup> is a much more robust species than *maya*, with a much broader, shorter pronotum in both sexes, heavier limbs and proportionately narrower, more trigonal ultimate tergite (supra-anal plate) in the female. It is now before me from Nouveau Chantier, French Guiana,<sup>76</sup> and Bartica, British Guiana.<sup>77</sup>

<sup>74</sup> Das Tierreich, Lief. 50, p. 293, (1927).

<sup>75</sup> *Liturgousa cayennensis* Saussure, Mitt. Schw. Entom. Gesell., III, p. 62, (1869), [♀; Cayenne].

<sup>76</sup> One male and one female; [Hebard Cln.]. These specimens were correctly reported by Chopard, from whom they were received in exchange.

<sup>77</sup> January 20 and 31, February 21, 1913; (H. S. Parish); three females.

The specimens recorded from Panama as *cayennensis* by Hebard<sup>78</sup> are probably all *maya*; certainly the Gatun and Corozal individuals, now before me, are that species. Similarly the Trinidad material there mentioned as *cayennensis*, being four males and six females from Caparo,<sup>79</sup> is fully representative of *maya*.<sup>80</sup>

The adult material of *maya* before me, consisting of eight males and fourteen females, shows there is a very marked amount of size variation in both sexes. This size fluctuation is largely individual, although more extensive series from a number of localities may demonstrate a regional association of averages at least. The following measurements (in millimeters) illustrate the extent of this variation in the series now before me.

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Length of caudal femur
♂, San Rafael, Vera Cruz, Mexico.	24.5	6.8	2.6	16	7.1
♂, Blue Creek, Quintana Roo, Mexico <sup>81</sup> .....	22.5	6.3	2.35	13.5	5.8
♂, Between Rio Colorado and Sabanillas, Costa Rica .....	24.8	7.8	2.35	15.3	7.8
♂, Caparo, Trinidad .....	22	6.1	2.26	13.8	6
♂, Caparo, Trinidad .....	24.3	6.5	2.52	15	6.5
♀, Mouth of Waspuk River, Nicaragua <sup>82</sup> .....	28.5	8.2	3.1	17	8
♀, Pozo Azul de Pirris, Costa Rica	29.6	8.7	3.02	18.2	8.2
♀, Cangrejal de Aserri, Costa Rica	32	9.8	3.52	18	9.3
♀, Surubres, Costa Rica .....	29.5	8.3	3.02	16.8	8
♀, Almirante, Panama <sup>83</sup> .....	27.5 <sup>84</sup>	9	3.36	18.3	9.2
♀, Caparo, Trinidad .....	29.3	7.5	2.85	15	7.14
♀, Caparo, Trinidad .....	32	8	3.36	15.3	8

In color there is marked and apparently independent variational range along three lines; first, the degree of emphasis of the lichenose mottling of the general pattern; second, the extent to which the tegmina are washed with rufescent; and third, the degree to which the more usually infusate discoidal field of the wings is rufescent except for the infusate distal fourth and thus distinctly contrasted with the infusate remainder of the wing. The mottling of the tegminal and pronotal pattern varies much as in *L. annulipes* (and also *cayennensis*), the number, size and disposition of the

<sup>78</sup> Trans. Amer. Entom. Soc., XLVIII, p. 331, (1923).

<sup>79</sup> June and August, 1913; (S. M. Klages); [A.N.S.P. and Hebard Cln.].

<sup>80</sup> The specimen from Pasaje, Ecuador, reported by Hebard as *cayennensis* (Proc. Acad. Nat. Sci. Phila., LXXVI, p. 131, (1924)) is seen to represent a small species quite distinct from *cayennensis* and apparently from *maya*. The condition is such that additional material must be secured before its true relationship can be determined.

<sup>81</sup> October 13, 1925; one male; [Hebard Cln.].

<sup>82</sup> Junction with Segovia River on Honduras-Nicaragua boundary line; (Dr. Theodore Bouchelle); one female.

<sup>83</sup> (Smith); one female; [M.C.Z.].

<sup>84</sup> Abdomen decurved toward apex, true length greater by several millimeters.

fuscout clouds showing a broad range, from one extreme in which they are almost obsolete (mouth of the Waspuk River) to the other in which the maculations are sharp, numerous and strongly contrasted (Cangrejal de Aserri and Surubres). The San Rafael, Vera Cruz male is quite greenish on the tegmina, with a very definite darker pattern, while the pronotum is almost immaculate. The dark maculations, when emphasized, have the tendency, usual in the genus, to concentrate at regular intervals along the principal veins.

The Waspuk female has the tegmina almost entirely washed with dull rufescent, that from Pozo Azul de Pirris with the discoidal field of same lightly washed with the same tone, while the male from between the Rio Colorado and Sabanillas has that area washed with mars orange. The proximal three-fourths of the discoidal field of the wings is rufescent washed in the female from "Costa Rica," that from Cangrejal de Aserri and the male from between the Rio Colorado and Sabanillas. In the latter case it is equally vivid with the tegminal wash, while in the female from Cangrejal de Aserri there is no tegminal correlation. The "Costa Rica" female has the tegmina with their base color rather pale, yet markedly maculate, and here also there is no apparent correlation of the tegminal and wing tones. The Pozo Azul de Pirris female, while, as remarked above, showing a light wash of rufescent on the tegmina, has no indication of rufescent in the wings. The evidence would thus indicate that the presence of a rufescent tone on the tegmina and discoidal field of the wings is independent of the general coloration and tegminal dark pattern, may be genetic, and its occurrence on either of these appendages may be without relation to what is found on the other. Available series of the genus are not sufficiently ample to determine just what may occur in the other forms of *Liturgousa*.

The distribution of *maya* is now known to extend from as far north as the State of Vera Cruz, Mexico (San Rafael<sup>85</sup>) and northern Yucatan (Temax), south along the eastern coast of Central America to at least the Segovia River district on the Honduras-Nicaragua boundary (the Waspuk River is a tributary coming in on the Nicaraguan side), and again in northeastern Panama (Almirante) and the Canal Zone.<sup>86</sup> On the western or Pacific slope of Central America we know it only from the localities given above for western Costa Rica and Corozal, Canal Zone, Panama.<sup>87</sup> We have no knowledge of its occurrence in the lowland forest belt of eastern Costa Rica, or on the Pacific coastal side of Central America north of Costa Rica. I feel confident, however, it will be found in the latter region.

<sup>85</sup> Hebard, Trans. Amer. Entom. Soc., LVIII, p. 211, (1932).

<sup>86</sup> Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 337, (1923), (as *cayennensis*, vide supra).

<sup>87</sup> Hebard, idem.

In western Costa Rica it definitely ranges to at least as high as Cangrejal de Aserri, which is at an elevation of 800 meters (2600 feet).

The individual taken between the Rio Colorado and Sabanillas was collected while on a hard day's pack journey of twenty miles, in forested broken country, and the exact elevation was not determined, the figures given above (1500-3940 feet) being the minimum and maximum of the intervening terrain. Eastward in South America the species ranges at least to Trinidad, although we lack definite data as to intermediate localities.

At Pozo Azul and between the Rio Colorado and Sabanillas it was taken running on the bark of trees in heavy forest. The species has been found adult in January, April, May, August, October, and November, Costa Rican representatives having been taken in January, April and August. It is known to occur immature in March, April, May, and August. The Costa Rican information alone shows its occurrence as quite small immature individuals and as adults on dates but four days apart (August 21 and 25), and at localities separated by not more than twenty miles (Pozo Azul de Pirris and between the Rio Colorado and Sabanillas). From these data it probably is at least two brooded and will be found adult throughout the year.

***Liturgousa atricoxata* Beier.**

*Liturgousa atricoxata* Beier, Mitt. Zool. Staatsinst. u. Zool. Mus. Hamburg, XLV, p. 14, (1931), [♀; Las Mercedes, Hamburg Farm, Rio Reventazón, Limón District, Costa Rica].

I am entirely unacquainted with this species, although I have spent a number of weeks in the field in areas adjacent to its type locality. Certain of the features given for it are by no means orthodox for *Liturgousa*, such as the smooth lateral margins of the pronotum (in the female sex), while the breadth of the latter across the supra-coxal expansions ("3 mm.") is exceptionally great for a pronotal length of 6 mm., a ratio found in no *Liturgousa* which I have seen. The coloration of the cephalic coxae and femora and of the prosternum and mesosternum is also as in no other species of *Liturgousa*. The future will probably show this is not a *Liturgousa*, but at this writing, to make the present study complete, there is no alternative but to present a translation of the entire original description and appended comments.

"♀. Ground color yellowish brown. Frontal shield very narrow. Ocellar protuberance distinct, eyes large, round. Pronotum moderately depressed, caudad of the supra-coxal dilation only weakly and gradually constricted, the disk supplied with irregularly scattered, sharp tubercles, the lateral margins smooth. Tegmen light yellowish brown, opaque, with brown basal and similar stigmal spot, elsewhere indistinctly mottled with brownish and whitish. The marginal field (of tegmen) densely and irregularly veined. Wings brown. Cephalic coxa unarmed, within blackish brown, except a narrow light band near the base. Cephalic femur within

blackish brown with lighter apex, externally flecked with brown and with a median longitudinal series of distinct tuberculations. Four discoidal and four external spines present (on cephalic femur); the groove near the base. Cephalic tibia with eight external spines, the sixth (from the apex) larger than its neighbors, with three brown transverse markings, of which the middle one is the largest. (Cephalic) metatarsus with three brown annulations, the first at the base, the second in the middle and the third distad. The remaining (cephalic) tarsal articles have the apices brown. Femora and tibiae of the median and caudal limbs always with four unequal annulations, the metatarsi brown proximad and distad, tarsal articles two and three on the apices, four and five entirely, brown. The metatarsus of the caudal pair as long as the succeeding joints together. Prosternum blackish brown, mesosternum similar but with a light cross band cephalad. Abdominal sternites beside the lateral margins always with a blackish brown maculation, which internally develops into a short, narrow cross-band.

"Body length, 23 mm., pronotum, 6 mm., breadth (of pronotum) 3 mm., (length of) metazona, 4 mm., (length of) tegmen, 15 mm.

"Type: 1 ♀, Costa Rica. Limon Plain at Las Mercedes, Hamburg Farm on the Reventazón, 10-30 meters above the sea, 12-30 kilometers from the Atlantic, August 15, 1923, F. Nevermann collector.

"A species known by the depressed form and light color."

#### MELLIERINAE

##### MELLIERA Saussure

*Melliera* Saussure, Societas Entomologica, VII, p. 123, (1892); Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 128, 147, (1894).

Genotype (by monotypy). — *M. atopogamia* Saussure (= *Acontista major* Saussure).

The genus is now known to contain three species, i. e. the genotype *M. major* (Saussure),<sup>88</sup> the new species here described, and a third new Guatemalan one being described by me elsewhere.

<sup>88</sup> *MELLIERA MAJOR* (SAUSSURE).

*Alcentista major* Saussure, Mém. Soc. Phys. Hist. Nat. Genève, XXIII, p. 22, (1872), [♂; Brazil].

*Melliera atopogamia* Saussure, Societas Entomologica, VII, p. 123, (1892), [♂, ♀; Sinaloa, Mexico].

Giglio-Tos (Das Tierreich, Lief. 50, p. 312, (1927)) synonymized *atopogamia* under *major*, although in the "Biologia Centrali-Americana" (Orth., I, pp. 148-149, (1894)) Saussure and Zehntner, permitted the two to stand as distinct. No reasons were advanced by Giglio-Tos for the establishment of the synonymy. Saussure and Zehntner (Biol. Cent.-Amer., Orth., I, pl. VII, figs. 7 and 8, (1894)) have also given colored figures of both sexes of what they referred to *atopogamia*. The same authors recorded the species from Sinaloa, Mexico; San Isidro, Guatemala, and Chontales, Nicaragua, while Giglio-Tos gives Brazil, Costa Rica, Nicaragua, and Mexico, doubtless all being from previous literature except Costa Rica, which probably refers to the new species of the genus here described. I have before me five males of *major* from Sinaloa, Mexico (see Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 185, (1923)), and I question the correctness of the Brazilian locality in the original material, as stated above. The material recorded from San Isidro, Guatemala and Chontales, Nicaragua may not represent *major*, as here understood, that from San Isidro possibly, and that from Chontales very probably being distinct. It is reasonable to suppose that Chontales material may be *chorotega* here described, and that from San Isidro may or may not represent a new species, more closely related to the Sinaloa insect, which is being described elsewhere.

In distribution *Melliera* is now known to range through the arid tropical belt of western Mexico and Central America from Sinaloa, Mexico south to Guanacaste, western Costa Rica, extending eastward in southern Mexico and Guatemala to the territory of Quintana Roo<sup>89</sup> and the western side of the elevated central area of Guatemala.<sup>90</sup> Nowhere to the southward of Quintana Roo is the genus known to reach into the Atlantic drainage. The record of *major* from "Brazil" I can only feel was due to erroneously labelled material, and without fresh corroborative evidence I would not extend the definitely determined range to include this very questionable record. No material of the genus is available in extensive representations from various portions of northern South America.

*Melliera chorotega*,<sup>91</sup> new species. Plate 8, figures 6 and 7.

? *Melliera* *major* Giglio-Tos, Das Tierreich, Lief. 50, p. 312, (1927), [Costa Rica].

Differing from *M. major* (Saussure), as represented by topotypic males of the synonymic *atopogamia* from Los Mochis and Venvidio, Sinaloa, Mexico,<sup>92</sup> in the smaller size, the low and little evident, rounded and not at all pointed paired tubercles or bosses cephalad on the metazonal portion of the pronotum, and in the shorter and slighter cephalic limbs. The female sex of *chorotega* is not known.

*Type*.—♂; Oricuajo, Rio Jesús Maria, western Costa Rica.<sup>93</sup> Elevation, 225 feet. September 2, 1927. (J. Fidel Tristán and J. A. G. Rehn; taken at light at night.) [Academy of Natural Sciences of Philadelphia, Type no. 5536.]

Size small (for genus); form essentially as in *M. major*.

Head strongly transverse, greatest depth contained one and five-eighth times in greatest width across eyes, latter moderately protuberant, globose, in cephalic view each occupying one-third of total width of head; occipital line, seen in cephalic aspect, as a whole nearly straight, lateral longitudinal impressions strongly but not narrowly impressed, cephalic face of occiput distinctly declivent ventro-cephalad; ocelli large, prominent, disposed in a depressed triangle; facial scutellum transverse, greatest median depth contained twice in greatest width of same, dorsal margin arcuate with center of arcuation slightly flattened. Antennae reaching slightly caudad of median coxae.

Pronotum with greatest width across supra-coxal dilation contained very nearly four times in length of same (as 34 to 130), the dilations evenly rounded; entire lateral margins unarmed, cephalic margin narrowly rounded, lateral borders of prozonal section slightly subangulately expanded at their

<sup>89</sup> The following record is of *M. major*: Petacap, Quintana Roo, Mexico; August 21, 1925; (A. Dampf); one male; [Hebard Cln.].

<sup>90</sup> This represents a new species described elsewhere, where full data are being given.

<sup>91</sup> After the Chorotegas, the aboriginal people of the Gulf of Nicoya and the coast of Guanacaste.

<sup>92</sup> See Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 185, (1923).

<sup>93</sup> See footnote number 15, under *Musonia surinama*.

middle, with a correlated narrow internarginal inflation of the dorsal surface, bounded mesad by the usual sculptured sulcus (Plate 8, figure 6), lateral margins of metazona (shaft) lightly concave, width at caudal margin equal to three-fourths that across supra-coxal dilation; surface of prozona moderately sculptured into a definite medio-cephalic shelf-like, but rounded, shoulder, bearing a fine medio-longitudinal sulcation, a median transverse concavity and a post-median pair of small, low, rounded bosses, separated from the main transverse sulcus by a second weak transverse impressed area; surface of metazona with the cephalic paired bosses, characteristic of the genus and *Zystropeltis*, definite but low and evenly rounded, not distinctly mammillate, narrowly separated by a continuation of the narrow medio-longitudinal sulcation of the prozona, surface of metazona caudad of cephalic bosses very shallowly and weakly, but still definitely, sub-sellate when seen in profile, surface of caudal section evenly ascending to the very low median inter-marginal thickening found in all *Melliera*.

Tegmina hyaline except that marginal field is subtranslucent, when extended caudad surpassing apex of abdomen by about prozonal length, greatest width contained three and a half times in greatest length; form, proportions and principal venation as usual in genus, apex arcuate sub-angulate; marginal field with venational reticulation moderately irregular and rather open. Wings with apex narrowly rounded.

Ultimate sternite (subgenital plate) moderately produced, lateral margins moderately oblique convergent caudad, interstyler portion of margin (caudal) equal to approximately one-fourth of proximal width of sternite, truncate; styles slightly tapering, substyliiform, faintly shorter than interstyler portion of margin.

Cephalic coxae, when extended caudad, reaching to pro-mesosternal suture, flexor margin with six to eight small, well-spaced denticulations: cephalic femora proportionately slender and delicate, greatest depth of same contained four and four-fifth times in length (in *major* four and one-tenth times), dorsal margin gently and quite weakly sigmoid when seen in profile; external margin with four regular spaced spines, plus the much smaller dentiform one on the genicular lobe, internal margin with following spine formula (reading distad) 111111111111, discoidal spines four, increasing in length from proximal one to third from base, which is longest, fourth about equal in length to second; internal groove slightly proximad of middle: cephalic tibiae rather slender, with extensor margin flatter and less arcuate than in *major*; external margin with ten teeth, internal margin with thirteen: cephalic metatarsi slightly longer than combined length of other tarsal articles. Median and caudal limbs proportionately quite short, as in all known members of the genus, and in fact of the subfamily; caudal femora with their apices falling slightly short of distal margin of fourth sternite.

General body color on dorsum mummy brown to bister and prout's brown, ventral aspect lightening to dresden brown and even buckthorn brown, on prosternum tending toward russet. Eyes mottled mummy brown and dresden brown; antennae passing from general color proximad through olive lake to yellow ochre distad, the articles there each in part olive lake. Tegmina and wings hyaline with venation pencilled in mikado brown, the radiate veins of the wings becoming bister distad, while proximad they and all the other wing veins are briefly but very distinctly washed with pale

corinthian red. Cephalic coxae russet, sometimes (paratype) externally as pale as tawny, marginal denticulations whitish; cephalic femora russet, externally sometimes (type) weakly washed with mummy brown, internally washed proximad with the same, external spines buffy with black tips, larger internal spines wholly shining black, smaller ones buffy, black tipped; discoidal spines as external spines; cephalic tibiae of general tone with spines buffy, black tipped, apical claw with concavity of curvature on inner side entirely black; cephalic tarsi as a whole bice green to buffy citrine, each article mummy brown distad. Median and caudal limbs of general color, all more or less distinctly but incompletely and irregularly multiannulate with mummy brown, including the tarsal articles.

#### MEASUREMENTS (IN MILLIMETERS)

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen	Length of cephalic femur	Length of caudal femur
♂, Oricuajo, Costa Rica, <i>type</i> . . . . .	39	10.9	2.85	28	8	8	6.72
♂, Las Cañas, Costa Rica, <i>paratype</i> ..	38	10.4	2.6	26.5	7	8.14	6.72

In addition to the type I have before me a paratypic male taken at Las Cañas, Guanacaste,<sup>94</sup> June 8, 1923. This specimen fully agrees with the type except that it is as a whole slightly smaller.

#### PHAEOMANTIS Beier

*Phaeomantis* Beier, Mittheil. Zool. Staatsinst. u. Zool. Mus. Hamburg, XLV, p. 17, (1931).

Genotype (by original designation).—*P. brevipes* Beier.

I am unacquainted with this genus and here present a translation of the generic description and original comments.

"♂. Facial scutellum (frontal shield) about twice as broad as high. Pronotum slender. Tegmina subopaque, brown, with opaque marginal (costal) field. Wings brown, with violet reflections. Cephalic limbs ('fangbeine') robust, the femora with four discoidal and four external spines. Apical internal lobes of the cephalic coxae not divergent. Median and caudal limbs exceptionally short, the metatarsus only as long as the combined length of the two succeeding articles. Ultimate tergite (supra-anal plate) very small, transverse.

"This new genus is placed in the group Stagmomantes and differs from all the previously referred genera in the shorter limbs and entirely brown tegmina and wings."

Female unknown.

From certain features, such as the very short median and caudal limbs and the sub-mammillate character of the pronotal surface, as mentioned

<sup>94</sup> Las Cañas is situated at the foot of the western slope of the Cordillera de Guanacaste, at an elevation of about 100 meters above the sea, on the Río de las Cañas, a tributary of the Río Tempisque. Its approximate position is 85° 6' W. and 10° 25' N.



in the specific description, I am convinced this genus is a member of the Mellierinae, related to *Melliera* and *Xystropeltis*. It is much less closely related to *Melliera* than it is to *Xystropeltis*, but differs from both in the opaque to subopaque tegmina of the male, particularly of the discoidal field, while the form of the pronotum, as described ("schlank"), would, without very definite qualification, fit neither of these genera. The failure of Beier to mention the character of the pronotal surface, aside from the paired tubercle groups, would indicate that the peculiarity in this respect seen in the very distinctive *Xystropeltis* is not present in *Phaeomantis*. Similarly Beier makes no mention of the distinct although low caudal tuberculation of the pronotal shaft seen in *Xystropeltis*.

Beier's description is exceedingly unsatisfactory, emphasizing purely color features, and it entirely fails to stress the general structure of the head, pronotal supra-coxal dilation, tegminal shape, structural character of the marginal field of the same (important in this subfamily), wing proportions and most of the male abdominal appendages.

***Phaeomantis brevipes* Beier.**

*Phaeomantis brevipes* Beier, Mittheil. Zool. Staatsinst. u. Zool. Mus. Hamburg, XLV, p. 18, 1931), [♂; Hamburg Farm, [Rio] Reventazón, 12-30 kilometers from the Atlantic coast, Limón District, Costa Rica].

The unique type was collected May 12, 1926. To make the present study comprehensive, I present a translation of the original specific description.

"♂. Color brownish. Antennae black. Lateral margins of the pronotum with delicate spaced blunt denticulations. Prozona and fore portion of metazona with intimations of two low tubercles. Tegmina entirely smoke brown, the marginal (costal) field opaque, discoidal field subopaque. Wings smoke brown with distinct blue-violet reflections. Cephalic coxae on the internal margin with seven distinct sharp denticulations, externally with three indistinct brown cross-bands. Cephalic femora with four discoidal and four external spines, the internal margin with four weakly defined brown cross-bands, the large internal spines entirely black with dark basal points, the discoidal spines light with darker apices. Tibiae with eleven external spines. Metatarsus (cephalic) beneath black, proximad and distad, the other tarsal joints beneath almost entirely black. Median and caudal limbs remarkably short, the tibiae of the last with three indistinct brown annulations. The apices of the tarsal articles blackish. The caudal metatarsus only as long as the two following tarsal articles together.

"Length of body 42 mm., pronotum 12.5 mm., breadth 3 mm., metazona 10 mm., tegmina 23 mm., cephalic coxae 7.5 mm., cephalic femora 9 mm., caudal femora 6.5 mm."

It is very probable this species is peculiar to the eastern lowland rain-forest district.

**XYSTROPELTIS**,<sup>95</sup> new genus

Related to *Melliera* Saussure, agreeing in the bimammillate dorsum of the metazona of the pronotum, short limbs and many other features, but separable at once by the strongly spined character of the lateral margins of the pronotum, the sharp and acute tubercles of the surface of the dorsum of the pronotum, and the infusate radiate field of the wings of the male. For comparison with Beier's *Phacomantis* the student is referred to my comments under the latter genus on a preceding page.

*Generic Description*.—Form slender, elongate, fully alate in male, female unknown. Pronotum slender, supra-coxal dilation distinct but rounded, lateral margins regularly dentate, particularly on metazona; surface of metazona bearing cephalad a pair of closely placed, acutely mammillate tubercles and caudad a low transverse elevation, remainder of surface of entire pronotum with scattered distinct tuberculiform asperities. Tegmina elongate, hyaline; marginal field with a network of anastomosing veinlets and in consequence numerous areolations. Wings elongate, in repose reaching to tegminal apices; discoidal field virtually hyaline, radiate field infusate. Cephalic coxae reaching caudad to caudal margin of prosternum, extensor margin denticulate; cephalic femora with four external spines, four discoidal spines, internal spines biseriata, groove proximad of middle; cephalic tibiae with ten external spines; cephalic tarsi with metatarsus longer than remaining articles together. Median and caudal limbs exceedingly short.

Genotype.—*X. lankesteri*, new species.

The genus is known only from the unique type specimen of the genotypic species.

**Xystropeltis lankesteri**,<sup>96</sup> new species. Plate 8, figures 2 and 3.

*Type*.—♂; Cachí, Costa Rica. (C. H. Lankester.) [Academy of Natural Sciences of Philadelphia, Type no. 5542.]

Size medium. Head in cephalic aspect transverse trigonal, greatest depth contained one and five-eighth times in greatest width across eyes; latter prominent, globose, somewhat directed cephalad, in cephalic aspect each is slightly less than one-third as wide as whole of head; occipital outline as seen in cephalic aspect ascending slightly to eyes laterad of usual paired sulciform impressions, between these the occiput is slightly convex laterad and shallowly but quite broadly concave mesad; ocelli prominent, trigonally disposed; facial scutellum transverse, greatest median depth contained two and one-third times in greatest width of same, dorsal margin arcuate, subcrenulate mesad. Antennae missing in type.

Pronotum with greatest width across supra-coxal dilation contained four and three-fifth times in greatest length of same, length of prozona but slightly more than one-fourth of the total pronotal length; cephalic

<sup>95</sup> From *Ξίστρος* scraper, and *πλετη* shield, in allusion to the rough pronotal surface.

<sup>96</sup> Dedicated to my friend Mr. C. H. Lankester, of "Las Concavas", Costa Rica, in remembrance of days afield and the unforgettable companionship of a brother naturalist.

margin regularly ovate arcuate, lateral borders of prozona cephalad of supra-coxal dilation nearly parallel, very faintly widening mesad and there with a weak adjacent surface inflation, as described under *Melliera chorotega*; spaced lateral spiniform dentations continuous and relatively regular in position and length from the junction of the cephalic and lateral margins caudad to the caudal margin, arcuation of margin of supra-coxal expansion slightly more pronounced cephalad and more gradual caudad, the lateral margins thence subconcave from full length of metazona; narrowest point of latter slightly cephalad of middle, but slightly wider than half the width across supra-coxal dilation, caudal margin very broadly arcuate, faintly sub-bilobate; surface of prozona with sculpture as described for *Melliera chorotega*, a number of distinct but small asperities irregularly disposed over the surface; transverse sulcus rather deeply impressed; surface of metazona with the strongly elevated paired mammillations closely placed, separated by a fine sulcation which is continued from the prozona but which is obsolete mesad on the metazona, the points (or nipples) of the mammillations appreciably diverging dorso-laterad, in profile the general dorsal outline of metazona is weakly sellate, the caudal elevation emphasized by a rounded median nodose swelling, which is also seen but much less marked in *Melliera*, surface of metazona with the scattered asperities pronounced and very evident, most of them very definitely tuberculiform in development.

Tegmina elongate, in general form and character essentially as in *Melliera*, greatest width contained slightly less than four times in length of same, apex rounded rectangulate; marginal field with its proximal lobation slightly broader than in *Melliera*, and in consequence the narrowing distad is quite evident, areolation of this field as in *Melliera*; stigma small, sub-circular, cicatriform. Wings with proportions and venation essentially as in *Melliera chorotega*.

Cephalic coxae with spines of extensor margin numbering seven; cephalic femora quite slender, greatest depth contained six times in greatest length of same, dorsal line of femora nearly straight, internal spines with the following formula (reading distad) IiIiIiIiIiIi; discoidal spines with third from base longest, proximad of these spines the ventral surface of femur shows a linearly disposed series of four to five small nodules; cephalic tibiae with ten external spines and thirteen internal ones, latter quite distinctly increasing in length distad. Median femora not more than half length of the cephalic femora, median tibiae subequal to femora in length. Caudal femora hardly reaching apex of third abdominal sternite, tibiae very faintly longer; caudal tarsi with metatarsus comprising one-third of total.

Abdomen with apex missing.

Base coloration clay color, at times becoming as dark as tawny-olive, and on the venter of the abdomen and sterna as light as cinnamon-buff and pinkish buff, locally frosted with hoary white. Eyes mottled mummy brown and dresden brown. Pronotum with virtually all the surface asperities (plus some non-structural color points) of the metazona and a few of those on the prozona blackish brown, marginal dentations largely of the same color, the remainder, which are chiefly in the post-dilation third of the metazona, creamy white. Tegmina hyaline with veins pencilled in buckthorn brown, mesad briefly hay's green along sections of the costal

margin, discoidal trunk and adjacent veins. Wings with discoidal field essentially as the tegmina, except for a few scattered intimations of nebulae of very weak prout's brown seen mesad; radiate field almost completely clouded with prout's brown, the extreme base, a narrow marginal area distad and the accessory venation whitish to whitish hyaline (peripheral), the main radiate veins pencilled with mummy brown distad, becoming tawny proximad. Cephalic coxae of general color, internally unmarked; cephalic femora internally with a median and a proximo-dorsal blotch of mummy brown, longer internal spines and their base areas entirely and the external and discoidal spines tipped with mummy brown; apical claw on internal face of cephalic tibiae very largely mummy brown; cephalic tarsi dull yellowish olive, articles annulate distad with mummy brown. Median and caudal limbs of general color, the tarsal articles very weakly and imperfectly annulate with dull brownish apically.

Length of body to and including fourth abdominal segment, 40.5<sup>97</sup> mm.; length of pronotum, 13.4; greatest width of pronotum, 2.91; length of tegmen, 35; greatest width of tegmen, 9.5; length of cephalic femur, 10; length of caudal femur, 6.27.

The type of this most interesting and unusual genus and species is unique, and unfortunately not quite perfect. Its very distinctive and remarkable characteristic features are, however, fully preserved. On account of the marked emphasis of the pronotal peculiarities in the male, the discovery of the female sex is looked forward to with considerable interest.

#### PHOTININAE

##### MACROMANTIS Saussure

*Macromantis* Saussure, Mém. Hist. Nat. Mexiq., IV, pp. 28, 77, (1871).

*Pentacantha* Stål, Öfv. K. Vet.-Akad. Förhandl., XXVIII, p. 400, (1872).<sup>98</sup>

Genotype (by selection of Kirby, 1904).—*Mantis ovalifolia* Stoll (= *Mantis hyalina* DeGeer).

This genus contains one of the largest existing species of the family Mantidae, which in the female sex has cephalic grasping limbs of unequalled strength, combined with an exceptional prothoracic and abdominal bulk. The sexes are quite dissimilar, the males of a slender, graceful build, with elongate, largely or completely hyaline tegmina and wings, while the females are of marked robustness, with broad, opaque, leaf-like tegmina, which fail to reach the apex of the abdomen.

Most authors have assigned at least two species to *Macromantis*, but as I am showing below only a single species can be recognized.

The range of the genus is coextensive with that of the single species.

***Macromantis hyalina* (DeGeer).** Plate 9, figure 6.

*Mantis hyalina* DeGeer, Mém. Hist. Ins., III, p. 410, pl. 37, fig. 1, (1773), [♂; "America" (probably Surinam)].

[*Mantis*] *ovalifolia* Stoll, Natuur. Afbeeld. Beschr. Spoken, etc., pp. 58, 78, pl. XIX, fig. 72, (1813), [♀; locality not given].

<sup>97</sup> Extremity of abdomen lacking. Probably the full length of the body would be about 52 mm.

<sup>98</sup> Based solely on *Mantis hyalina* DeGeer.

[*Macromantis ovalifolia*] var. *nicaraguae* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 150, (1894), [♂; Chontales, Nicaragua].

Pejivalle. Elevation, 1850 feet. August 11, 1927. (Rehn; clinging to net door of building in morning.) One male.

Recent authors generally have endeavored to differentiate two species, one of which was supposed to have the marginal field of the tegmina of the male entirely hyaline, for which the name *hyalina* was used, and another having the same area wholly or in large part opaque like the remainder of the tegmina, to which the name *ovalifolia* was applied. Chopard in 1911, when reporting both sexes from St. Jean du Maroni, Nouveau Chantier and La Forestière, French Guiana,<sup>99</sup> stated it was impossible to differentiate the females before him from that described as *ovalifolia* by Stoll, while the males fully agreed with DeGeer's description, and Stoll's subsequent description and figure of *hyalina*.<sup>100</sup> He further stated that he did not possess male individuals with the marginal field opaque, and also that all the males he had seen from Surinam and the region of the Maroni represented *hyalina* DeGeer.

With twelve males and five females of the genus before me, from localities extending from British Honduras to French Guiana and the State of Pará, Brazil, I am able to say definitely that we know but one species of the genus *Macromantis*, to which the name *hyalina* DeGeer must be applied. Chopard's deductions are fully supported by the present series, which shows geographic variation in size, but in series from a single locality the species is reasonably constant.

The largest specimens I have seen are those of both sexes from Jimenez and Los Mangos, Cauca, Colombia, the measurements of which have already been given by Hebard,<sup>101</sup> and the Pejivalle male, here reported, the measurements of which are: length of body, 108.3 mm.;<sup>102</sup> length of pronotum, 35; greatest width of pronotum, 8; length of tegmen, 84; greatest width of marginal field of tegmen, 6.3. As shown by the dimensions already published, Guianan and lower Amazonian individuals average distinctly under the above figures, while the extremes of a series of five Nicaraguan males<sup>103</sup>

<sup>99</sup> Ann. Soc. Entom. France, LXXX, p. 323, (1911). I have before me, received from Chopard, one male from Nouveau Chantier and a female from St. Laurent du Maroni, as well as another male, received through Le Moutl, labelled simply "Maroni", French Guiana.

<sup>100</sup> Natuur. Afbeeld. Beschr. Spoken, etc., pp. 60, 78, pl. XX, fig. 75, (1813), [♂; locality not given].

<sup>101</sup> Trans. Amer. Entom. Soc., XLV, p. 133, (1919).

<sup>102</sup> To apex of ultimate tergite (supra-anal plate).

<sup>103</sup> Eden, Nicaragua; May 17, 1922; (Wharton Huber); one male: May to September, 1922; (J. S. McKenzie); one male: June-August, 1922; (Theo. W. Bouchelle); one male; [A.N.S.P.]. Great Falls, Pis Pis River, ten miles north-west of Eden, Nicaragua; May 24, 1922; (Wharton Huber), two males; [A.N.S.P.]. The male of which a photograph from life is reproduced in Plate 9, figure 6, is one of these specimens.

are as follows: length of body, 100.5,104; length of pronotum, 33.3,35; greatest width of pronotum, 7.5,7.9; length of tegmen, 77,80; greatest width of marginal field of tegmen, 5.6,6. A male from San Antonio, British Honduras,<sup>104</sup> representing the most northern point from which the genus is at present known, is somewhat smaller<sup>105</sup> than the Eden minimum, more nearly approximating French Guianan males. From figures already published and those here given, it would appear that the maximum size occurs from Colombia north to Nicaragua, while eastward in the Guianas and the region of the lower Amazon, and north of Nicaragua, at the periphery of the range, the size is somewhat less.

The evidence as to the hyaline character or opaqueness of the marginal field of the tegmina of the male, and which has been used as the basis for the recognition of two so-called species, is equally interesting. The only males before me with this area non-opaque are the two from French Guiana above mentioned, and in these the narrow distal section of the field is moderately opaque. The male from Igarapé-assú, State of Pará, Brazil, has somewhat more than the distal half opaque green, the remainder hyaline; that from Jiminez, Colombia has the opaque area slightly greater, extending distinctly proximad along the coastal margin, while one from the Piches and Perene Valleys, eastern Peru,<sup>106</sup> completely lacks any hyaline area. The Pejivalle male has the field almost entirely opaque, the hyaline section being represented merely by a less opaque strip proximad along the humeral vein trunk. The Eden and Great Falls series show conditions from that found in the Jiminez, Colombia, male to an opposite extreme virtually as generally opaque green as the Pejivalle individual, while the San Antonio, British Honduras specimen is faintly less opaque than the Colombian male. It is thus evident that while the Guianan males have the marginal field of the tegmina more completely hyaline, this is probably a relatively local condition; that lower Amazonian males show increasing opacity; and that while in Costa Rica and Peru we find the greatest degree of the same, to the northward the degree of transparency appears to increase. It is completely evident that two species are not represented, nor even definable geographic races of one.

The variety *nicaraguae* was based on a single male, said to differ from *ovalifolia* (= *hyalina*) of the Guianas in that the cerci are shorter, more terete, the articles more abbreviate and the distal article hebetate. This, as suggested by Saussure and Zehntner, is purely individual and probably due to injury or regeneration. A male from Maroni, French Guiana, now before me, has one cercus of somewhat similar character, the other one

<sup>104</sup> May, 1931; (J. J. White); [Hebard Chn.].

<sup>105</sup> Length of body, 94 mm.; length of pronotum, 31.5; greatest width of pronotum, 7.3; length of tegmen, 71.5; width of marginal field of tegmen, 5.5.

<sup>106</sup> Elevation, 2000-3000 feet; [U.S.N.M.I.].

being lacking, and I am convinced this condition is abnormal. Those males from Nicaragua, now before me, with uninjured cerci, have them perfectly normal in length, shape and the marked acuteness of the distal article.

The present collection includes the very large egg-mass of a mantid which probably was made by this species. It was found at Station 52 miles on the Atlantic Railroad, near Peralta, Costa Rica, August 4, 1927, by C. H. Lankester. Its general dimensions are, length, 50 mm.; greatest width, 40; thickness 18. The structure is loose and spongy, built up of successive delicate vertical layers, arcuate in transverse disposition on each side of the central egg group. It had apparently been fastened by one whole side to a flat surface, either a board or tree-trunk.

In distribution the species ranges from British Honduras (San Antonio) south to western Colombia and the eastern slopes of the Peruvian Andes (Piches and Perené Valleys), eastward to the Guianas and the eastern part of the State of Pará, Brazil. What the area of distribution in Brazil south of the main Amazon is, remains to be determined. The genus and species is one of the humid, lowland Tropical Zone. In Costa Rica the highest and only point from which it is definitely known (Pejivalle), is at 1850 feet elevation. In seasonal occurrence it is before me from as early as February (Nouveau Chantier) to definitely as late as August (several localities). Almost nothing is known regarding the habits of the species. A female from Jimenez, Colombia is labeled as having been taken while "at rest under leaves."

#### CHOERADODINAE

##### CHOERADODIS Serville

*Choeradodis* Serville, Ann. Sci. Nat., XXII, p. 50, (1831).

*Craurusa* Burmeister, Handb. der Entom., II, Abth. II, pt. 1, p. 542, (1838).<sup>107</sup>

Genotype (by designation of Giglio-Tos, 1927).—*C. strumaria* (Linnaeus).<sup>108</sup>

This genus is one of the few mantid entities possessing lateral foliaceous expansions to the prothorax. It includes a number of tropical American species, and also two Oriental forms, one of the latter probably confined to Ceylon (*C. squilla*), the other occurring also in peninsular India north to the Khasi Hills of Assam (*C. cancellata*).

The exact number of species found in South America is still uncertain, as the genus requires revisionary work before this can definitely be determined. As found in America, however, *Choeradodis* breaks into two groups on the character of the spination of the dorsal margin of the cephalic coxae.

<sup>107</sup> Based solely on the Asiatic *C. cancellata* (Fabricius).

<sup>108</sup> Kirby in 1904 (Synon. Catal. Orth., I, p. 219) indicated as the genotype *C. rhombicollis* (Latreille), which designation, however, cannot hold, as *rhombicollis* was not one of the originally included species. The subsequent designation of Giglio-Tos meets this requirement and consequently is valid.

One of these groups is basically Guianan and Amazonian, the other Central American, Colombian, and Ecuadorian. But a single species is found in Central America.

**Choeradodis rhombicollis** (Latreille).<sup>109</sup> Plate 9, figures 1-5.

*Mantis rhombicollis* Latreille, in Humboldt and Bonpland, Rec. Observ. Zool. et Anat. Comp., II, p. 103, pl. XXXIX, figs. 2 and 3, (1817),<sup>110</sup> [♂; locality not given, but is understood to be the interior of "New Spain"].

*Choeradodis servillei* Wood-Mason, Journ. Asiat. Soc. Bengal, XLIX, pt. 2, p. 83, (1880), [♂; Caché [Cachí], Costa Rica: juv. Chiriqui, [Panama]].—Wood-Mason, Journ. Asiat. Soc. Bengal, LIII, pt. 2, p. 240, fig. 8, (1884), [same material].—Wood-Mason, Catal. Mantodea, no. 1, p. 14, figs. 7 and 12, (1889), [same material].—Saussure and Zehntner, Biol. Centr.-Amer., Orth., I, p. 126, pl. IX, figs. 1 and 2, (1894), [♂, ♀; Panima, Vera Paz, Guatemala; Chontales, Nicaragua; Caché [Cachí], Costa Rica; Volcan de Chiriqui, 2000-3000 feet, Panama].—Giglio-Tos, Das Tierreich, Lief. 50, p. 337, (1927), [Colombia, Costa Rica, Guatemala, Nicaragua, Panama].

*Choeradodis brunneri* Wood-Mason, Journ. Asiat. Soc. Bengal, LI, pt. 2, p. 21, (1882), [♀ and juv.; Santa Fé de Bogotá, New Grenada [Colombia]].

La Emilia, Guápiles District. Elevation about 1000 feet. September 14, 1927. (Rehn; beaten from low vegetation in clearing of dense forest.) One female.

Cachí. (C. H. Lankester.) Two males.

Tarbaca.<sup>111</sup> May to July, 1903. (Underwood.) One male. [Hebard Cln.]

Ciruelas.<sup>112</sup> (A. Alfaro.) One male.

Pozo Azul de Pirrís. (Carriker.) One male, one female. [Hebard Cln.]

"Costa Rica." (Carriker.) Two males. [Hebard Cln.]

<sup>109</sup> Serville's *C. peruviana* (Hist. Nat. Ins., Orth., p. 207, (1839)) has been placed as a synonym of *rhombicollis* by Giglio-Tos (Das Tierreich, Lief. 50, p. 337, (1927)). The name was based on a specimen lacking the abdomen, presumed to be a female, but which in all probability is a male, judging from the description. Until we know more concerning the species of the genus occurring in Peru, I prefer to withhold comment.

Hebard recently (Trans. Amer. Entom. Soc., LIX, p. 29, (1933)) has placed as a synonym of this species Beier's *Choeradodis columbica* (Mitt. Zool. Staatsinst. u. Zool. Mus. Hamburg, XLV, p. 16, (1931), [♂; Colombia]). An examination of Beier's description shows, however, that he was correct in referring *columbica* to the neighborhood of *strumaria*, to which it is more nearly related. The spination of the cephalic coxae, as described by Beier, indicates the proper position of the species and removes it from the vicinity of *rhombicollis*. Hebard was misled by the pronotal form of *columbica*, which suggests that of *rhombicollis*, and also by the pronounced variability of the black markings of the internal face of the cephalic femora known to exist in the latter species. While I have seen males of *rhombicollis* with the pronotal measurements equal to those of *columbica*, I have yet to see one of the former with the tegmina as long as 66 millimeters, the length given for *columbica*. Apparently *columbica* is a western analog of *strumaria*, either a distinct species or a geographic race, unless its features should be covered by individual variation in typical Guianan *strumaria*.

<sup>110</sup> The date usually given for the whole volume is 1833, but as Sherborn has shown (Ann. and Mag. Nat. Hist., (7), III, p. 428, (1899)) livraison 10 of the second volume, which contained page 103, was published in 1817.

<sup>111</sup> South of San José, about six kilometers from the town of Aserri.

<sup>112</sup> A station on the Pacific Railroad, near the Rio Ciruelas, between San Antonio de Belén and Turrúcares. Elevation somewhat over 500 meters.



After a careful examination of the literature involved I fully agree in the synonymy of *servillei* and *brunneri*, given above, which was established by Hebard in 1923.<sup>113</sup> With a series of the species before me consisting of twenty-four males and eight females, I find there is no possibility of recognizing more than a single species, which shows in both sexes variation in the pronotal outline, in general size and in the extent and shape of the black markings on the internal face of the cephalic femora. The two Cachi males and three from a limited area in eastern Nicaragua<sup>114</sup> show in each small series enough variation in pronotal form to demonstrate the impossibility of using the exact outline of the expansion as a specific feature. The accompanying photographs (Plate 9, figs. 1-5) show this more clearly than any amount of description. In proportions of the pronotal expansion the two Cachi males alone show the following extremes: length, 18,21 mm.; greatest width of expansion, 24.5,25.2. In general size the smaller of the Cachi males and that from Pozo Azul de Pirris show the following extremes: length of body, 52,59 mm.; length of pronotum, 18,23; greatest width of expansion of pronotum, 24.5,30.5; length of tegmen, 48.5,54.5; greatest width of tegmen, 14,16.5.

While it is evident there is a considerable amount of individual variation in size, there is, apparently, a fair regional constancy, at least judging from the relatively extensive representation of the male sex available. In Costa Rica the male specimens from Tarbaca, Cachi, and Ciruelas are smaller than that from Pozo Azul de Pirris, which is as would be expected, while the La Emilia female is slightly larger than that from Pozo Azul de Pirris. This is definitely correlated with the evidence of the remainder of the whole series studied, i. e. that the optimum size is found in the low-land rain-forest Tropical Zone, and that little size difference is noted between individuals from the most northern and most southern points within this zone. As Cachi is virtually at the upper border of the Tropical Zone, and Tarbaca is above it, while Ciruelas is on the drier Pacific slope, we find there an evident depauperation in size.

The black markings on the internal face of the cephalic femora show so much variation in extent in any series, it is at once evident no specific value can be given to the extremes or numerous intermediate conditions of the maculations there found. There is no correlation of their extent with any special shape of the pronotal expansion, neither is the same feature sex correlated, although extensively marked specimens are proportionately more numerous among the females. There is also no areal or geographic correlation of the extent of this marking.

<sup>113</sup> Trans. Amer. Entom. Soc., XLVIII, p. 338.

<sup>114</sup> Eden, Nicaragua (14° 0' N.; 64° 26' W); June-September, 1922; (J. S. McKenzie); one male: August 28, 1922; (J. S. McKenzie); one male. Great Falls, Pis Pis River, ten miles northwest of Eden, Nicaragua; April 23, 1922; (Wharton Huber); one male.

The distribution of *rhombicollis* extends from British Honduras (Punta Gorda<sup>115</sup>) and central (Panima, Vera Paz) and eastern<sup>116</sup> Guatemala south, within its area of zonal occurrence, to Ecuador, both eastern and western.<sup>117</sup> What the eastern limits of its distribution in northern South America are, remains to be determined. Within Costa Rica the species is one of the Atlantic Tropical Zone rain-forest belt, and of suitable areas of the Pacific Tropical semi-arid district, also occurring in apparently localized areas in the Meseta Central (Tarbaca), probably as an intrusive from the Pacific side. The sole locality in Costa Rica from which the species was previously known is Cachí.

Little is known of the habits of the species, other than that the males are sometimes attracted to lights at night, while the females have been encountered in daytime in clearings in dense forest, hiding in low vegetation. Seasonally the species occurs adult from as early in the year as February (Punta Gorda, British Honduras) in Central America, and in Ecuador as early as January 3,<sup>118</sup> to at least as late as September 14 (La Emilia).

#### MANTINAE

##### STAGMOMANTIS Saussure

*Stagmomantis* Saussure, Mittheil. Schweiz. Entom. Gesell., III, p. 56, (1869).

*Leptococe* Rehn, Genera Insectorum, Orth., Mantidae, Vatinæ (fasc. 119), pp., 11, (1911). (Genotype.—*L. thoracica* Rehn=*Stagmomantis carolina* (Johanns.).)

*Stauromantis* Giglio-Tos, Bull. Soc. Entom. Ital., XLVIII, p. 54, (1917). (Genotype.—*Stagmomantis theophila* Rehn.)

*Auromantis* Giglio-Tos, idem, p. 55. (Genotype.—*Mantis limbata* Hahn.)

*Oromantis* Giglio-Tos, idem, p. 56. (Genotype.—*Stagmomantis nahua* Saussure.)

*Uromantis* Giglio-Tos, idem, p. 56. (Genotype.—*Stagmomantis heterogamia* Saussure and Zehntner.)

Genotype.—By subsequent designation of Rehn, 1904,<sup>119</sup> *Gryllus* (*Mantis*) *carolinus* Johansson.

The synonymy given above has been due to two causes, the first, that for *Leptococe*, being the imperfect definition of the subfamily Vatinæ in virtually all literature of the past, and second, the unwarranted subdivision of a quite definite natural group into a number of supposedly valid genera. The relegation of *Leptococe* to synonymy is discussed on a subsequent page under *Stagmomantis carolina*. The creation of that genus was entirely due to the emphasis which authors had placed on the carination of certain limbs, a feature which for decades also had obscured the true position of

<sup>115</sup> February, 1931; (J. J. White); one male; [Hebard Cln.].

<sup>116</sup> Morales, Guatemala; June, 1929; (J. J. White); one male; [Hebard Cln.].

<sup>117</sup> In addition to the Ecuador material already reported by Hebard (Proc. Acad. Nat. Sci. Phila., LXXVI, p. 131, (1924)) I have before me two males from Dos Puentes, Ecuador; elevation, 1750 feet; January 3, 1931; (W. J. Coxe); one female from Bucay, Ecuador; (F. Campos R.).

<sup>118</sup> The specimens recorded above from Dos Puentes.

<sup>119</sup> Proc. U. S. Nat. Mus., XXVII, p. 562.

the genus *Stagmatoptera*, and caused it to be removed to the Vatinæ, while its correct position, as here shown, is very close to *Stagmomantis*.

The so-called genera into which Giglio-Tos split *Stagmomantis* of authors, have already been placed in synonymy by Hebard,<sup>120</sup> who at that time expressed his conviction that the characters used "have at best no higher than group value within the genus." With this conclusion I thoroughly agree, after an examination of over nine hundred adult specimens of the species here considered to belong to *Stagmomantis*, and representing all which appear to be valid. This entire series is contained in the Philadelphia collections.

To apply consistently the "yard-stick" used by Giglio-Tos in the recognition of his divisions as genera, would result in a meaningless and unwarranted multiplication of generic names, completely beclouding the fundamental theory that genera are to illustrate relationship, and not merely to magnify minor differences. Giglio Tos' attempt to follow his "rule of thumb" in this respect has resulted in several cases, in his removal from one another of closely related species, and their arrangement as misfits with others having nothing in common, except the single feature used by him as of outstanding importance. In addition some of these so-called generic features are purely relative, such as the degree of emphasis of the teeth on the cephalic coxæ and the length of the tegmina in the females of various species.

Of the genera split off by Giglio-Tos from the previous conception of *Stagmomantis* but one, that of *Isomantis*,<sup>121</sup> based on *Mantis domingensis* of Beauvois, a species confined to certain of the Greater Antilles, is a recognizable genus, possessing as it does a combination of characters not found in the species here considered to belong to *Stagmomantis*. This opinion is in agreement with that already expressed by Hebard regarding *Isomantis*.<sup>122</sup>

The various groups of species which, after extensive study, I feel are recognizable in *Stagmomantis*, do not accord with the entities into which Giglio-Tos broke that genus, largely due to his knowledge of certain species having been drawn solely from the literature. With a number of these species before me as type, paratypic or topotypic material, it is possible to give a more logical specific arrangement than that of Giglio-Tos' monograph.<sup>123</sup>

In showing the relationship of *Stagmomantis* to the more closely allied genera, I would place before it the above-mentioned *Isomantis* Giglio-Tos.<sup>124</sup> This Antillean genus has certain very definite and distinctive

<sup>120</sup> Trans. Amer. Entom. Soc., XLVIII, p. 339, (1923).

<sup>121</sup> Bull. Soc. Entom. Ital., XLVIII, p. 54, (1917).

<sup>122</sup> Trans. Amer. Entom. Soc., XLVIII, p. 339, (1923).

<sup>123</sup> Das Tierreich, Lief. 50, pp. 378-389, (1927).

<sup>124</sup> Bull. Soc. Entom. Ital., XLVIII, p. 54, (1917).

features when compared with *Stagmomantis*, such as the transverse tegminal stigma (♀) or stigmal spot (♂), the hyaline, non-tessellate character of a considerable part of the wings of the female, and the strongly bifid apex of the robust, instead of simple, elongate falcate or spiniform, sinistral ventral genital valve of the male. The latter feature alone is an unusual one, in no way even suggested by any *Stagmomantis*.

Arranging the species of *Stagmomantis* in species group which appear to be natural, and proceeding progressively from those which in certain features resemble more nearly *Isomantis*, we have the following disposition:

Heterogamia Group .....	{ <i>venusta</i> S. & Z. <i>parvidentata</i> Beier <i>heterogamia</i> S. & Z.
Nahua Group .....	{ <i>nahua</i> Sauss. <i>vicina</i> Sauss. <i>centralis</i> G.-T.
Californica Group .....	{ <i>californica</i> R. & H. <i>colorata</i> Heb.
Floridensis Group .....	<i>floridensis</i> Davis
Carolina Group .....	{ <i>hebaridi</i> Rehn <sup>125</sup> <i>carolina</i> (Johann.)
Fraterna Group .....	<i>fraterna</i> S. & Z.
Gracilipes Group .....	<i>gracilipes</i> Rehn
Limbata Group .....	{ <i>limbata</i> (Hahn) <i>montana</i> S. & Z.
Theophila Group .....	<i>theophila</i> Rehn

This arrangement has been based on a comparative analysis of a dozen or more characters in all the species. Among these features are the shape and degree of curvature of the hook on the dorsal and the spine of the ventral sinistral genital valves of the male, the truncate, convex or emarginate character of the margin of the inter-stylar apex of the ultimate sternite (subgenital plate) of the same sex, the shape of the ultimate tergite (supra-anal plate) of the female, the general type of spination of the cephalic coxae, the shape and proportions of the facial shield, the presence and character, and degree when present, of any infuscation of the wings in both sexes, the form and marginal spination of the pronotum, and the general shape and proportions of the organs of flight in both sexes. The transparent or opaque character of the marginal field of the male tegmina, which was so strongly dwelt upon by Giglio-Tos, appears to me to be far less fundamental and valuable than the features given above.

The groups here recognized show definite geographic analogies in the distribution of their component species, and would seem to represent independent stocks in the evolutionary development of the genus. The limita-

<sup>125</sup> Described in Trans. Amer. Entom. Soc., LXI.

tions of a linear sequence naturally to some extent mask what would appear to be their phylogenetic arrangement. The California Group clearly represents one divergent stock, the Gracilipes Group another and the Fraterna group a third, each probably diverging from the phylogenetic trunk at a point approximately as in the above linear sequence. The California Group has distinctive male genital features (i. e. of both dorsal and ventral sinistral valves and of the apex of the ultimate sternite), as well as very definite color peculiarities of abdomen, tegmina and wings in its brown phase individuals. The Gracilipes Group has in its single species a readily recognized combination of features, of which the triangularly produced ultimate tergite (supra-anal plate) of the female is found in no other *Stagmomantis*. The Fraterna Group, made up solely of *fraterna*, is puzzling, showing as it does certain tendencies, as the bisinuate transverse ultimate tergite of the female, the slightly convex margin of the ultimate sternite in the male, and the shape of the head and pronotum, which are shared to a marked degree with other groups, but in the broad and depressed, cultriform yet apically spiniform ventral sinistral genital valve of the male it is distinctive and unique, the only suggestion of this elsewhere in the genus being the faintest possible one in the otherwise very different Gracilipes Group.

The Theophila Group very definitely shows the relationship which *Stagmomantis* bears to the genus *Stagmatoptera*. The latter must be bodily removed from the subfamily Vatinae, where it has reposed for many years, and placed in the immediate neighborhood of *Stagmomantis*. The subfamily Vatinae, as it has been generally understood, is an arbitrary and unnatural assemblage, which must be dismembered if we are to have consistent and balanced values in the primary divisions of the Mantidae. At this writing time and space do not permit this to be taken up, but the present critical study of *Stagmomantis* demonstrates beyond any question the necessity for removing *Stagmatoptera* from the Vatinae and placing it in the immediate vicinity of *Stagmomantis*, the Theophila Group definitely establishing the relationship of the two genera. The sole character which has been utilized to hold together the Vatinae is the carination of the caudal tibiae, and this is intimated quite definitely in *Stagmomantis limbata*, *montana*, and *theophila*, so much so that the female sex of each of the latter two had been described as species of *Stagmatoptera*.

*Distribution*.—The genus *Stagmomantis* is one of the widest distributed genera of New World Mantidae, although a single wide-ranging species (*carolina*) is responsible for most of the peripheral points of the generic distribution. The most northern points of the range of the genus are extreme southern Pennsylvania, central Ohio and Indiana, southern Illinois, Missouri, Kansas, southeastern Nebraska, central Colorado, southern Utah, southern Nevada and southern California. Thence it extends southward

to Florida and the Gulf Coast, across Mexico and Central America (except at high altitudes), and into northern South America, ranging east to British Guiana and Trinidad, south to the Amazon at Obidos, Brazil, and in the Andean region at least as far as Ecuador.

*Key to Costa Rican Species of Stagmomantis*

**Males**

1. Spination of flexor margin of cephalic coxae well spaced, biseriate, the larger ones lamellato-dentate, strikingly evident. Lateral margins of pronotum in large part rather closely dentate.
 

*theophila* Rehn

Spination of flexor margin of cephalic coxae weaker, in some species almost obsolete, when evident usually biseriate, the larger ones never lamellato-dentate. Lateral margins of pronotum unarmed or at most denticulate. .... 2
2. Wings clear hyaline, not infusate. .... 3
 

Wings infusate to a variable degree, or when infuscation is weak the marginal field of the tegmina is opaque. .... 5
3. Pronotum with lateral margins of shaft almost entirely subparallel; outline of cephalic third of pronotum showing a definite constriction cephalad of supra-coxal expansion, not as a whole ovate. Limbs more slender. Marginal field of tegmina at least in part hyaline. .... 4
 

Pronotum with lateral margins of shaft concave for much of their length; outline of cephalic third of pronotum regularly elongate elliptical. Marginal field of tegmina opaque. (Dorsal sinistral genital valve strongly recurved at apex.)

*m. montana* Saussure and Zehntner (clear winged type)
4. Size larger. Form moderately robust. Marginal field of tegmina entirely hyaline. (Dorsal sinistral genital valve blunt at apex, not distinctly recurved. .... *carolina* (Johannson)
- Size smaller. Form quite slender. Marginal field of tegmina at least in part opaque. (Dorsal sinistral genital valve ?)
 

*parvidentata* Beier (clear winged type)
5. Pronotum with outline of cephalic third of pronotum regularly elongate elliptical. Cephalic limbs more robust, flexor margin of cephalic coxae with distinct biseriate armament. Dorsal sinistral genital valve strongly recurved at apex.
 

*m. montana* Saussure and Zehntner (infusate winged type)

Pronotum with lateral margins of cephalic third of pronotum showing a definite constriction cephalad of supra-coxal expansion. Cephalic limbs less robust; flexor margin of cephalic coxae with armament weak or even subobsolete. Dorsal sinistral genital valve at most but briefly recurved at apex. .... 6
6. Form more robust. Pronotum less attenuate, stouter, supra-coxal dilation less pronounced and more gradual proportionately. (Marginal field of tegmina opaque.) .... *centralis* (Giglio-Tos)
- Form more slender. Pronotum distinctly more slender, supra-coxal dilation more sharply and strongly pronounced. .... 7

7. Pronotum not exceptionally elongate, shaft of average proportions, least width of shaft contained barely six times in length of same. Marginal field of tegmina hyaline or subhyaline, not definitely opaque. .... 8
- Pronotum markedly elongate, shaft very narrow and attenuate, least width of shaft contained nearly or quite ten times in length of same. Marginal field of tegmina opaque. .... 9
8. Form more robust. Head more transverse, eyes more protuberant laterad. Pronotum with supra-coxal expansion sharper, faintly subobtuse-angulate; lateral margins of collar and shaft of pronotum distinctly denticulate. Apex of dorsal sinistral genital valve with apical recurvature short, thick and sharply bent downward. Spine of ventral sinistral genital valve regularly arcuate and tapering. .... *nahua* Saussure
- Form more attenuate. Head less strongly transverse, eyes less protuberant laterad. Pronotum with supra-coxal expansion slightly less decided, in outline more evenly arcuate; lateral margins of collar and shaft of pronotum very obsoletely denticulate. Apex of dorsal sinistral genital valve with apical recurvature more delicate and open. Spine of ventral sinistral genital valve quite sharply arcuate-rectangulate near base, the portion distad aciculate. .... *vicina* Saussure
9. Denticulations of flexor margin of cephalic coxae and lateral margins of pronotum definite but fine. Tegmina with cross-veins of most of discoidal field flexed sigmoid, their trend not as a whole at right angles to main veins.
- parvidentata* Beier (infusate winged type)
- Denticulations of flexor margin of cephalic coxae and lateral margins of pronotum subobsolete to obsolete. Tegmina with cross-veins of most of discoidal field basically transverse, their trend as a whole at right angles to main veins.
- heterogamia* Saussure and Zehntner

#### Females

1. Tegmina and wings not reaching caudad of caudal coxae. .... 2
- Tegmina and wings reaching caudad of caudal coxae. .... 4
2. Pronotum with supra-coxal expansion distinct and quite evident, although rounded. Tegmina with marginal field evenly and not sharply narrowing in distal third. Head in general elevation more triangular, occipital line of same straighter seen in cephalic aspect, juxta-ocular sections of same more distinctly set off from remainder of occiput. .... *nahua* Saussure
- Pronotum with supra-coxal expansion much less evident rounded dilations of lateral margins. Tegmina with marginal field having distal fourth rather sharply arcuate-sinuate to tegminal apex. Head in general elevation less strongly triangular, occipital line of same slightly more arcuate seen in cephalic aspect, juxta-ocular sections of same very weakly set off from remainder of occiput. .... 3
3. Size averaging smaller (pronotum, 12.5-14 mm.). Pronotum with cephalic fourth broader, lateral margins there subparallel for a

- short distance, not evenly converging from supra-coxal expansion to cephalic extremity. Apices of wings, when closed, abruptly truncate. .... *vicina* Saussure
- Size averaging larger (pronotum, 15-20 mm.). Pronotum with cephalic fourth narrower, lateral margins there more evenly converging cephalad from supra-coxal expansion. Apices of wings, when closed, rounded rectangulate. .... *centralis* (Giglio-Tos)
4. Form elongate, build delicate for sex. Pronotum with its shaft long and very slender; lateral pronotal margins delicately and briefly spined. Tegmina and wings covering no more than half of abdomen. Ultimate tergite (supra-anal plate) very short, strongly transverse, with distal margin weakly bisinuate. .... *heterogamia* Saussure and Zehntner
- Form less elongate, more robust. Pronotum with shaft less attenuate; lateral pronotal margins markedly spinose. Tegmina and wings covering all or at least three-fourths of abdomen. Ultimate tergite (supra-anal plate) low trigonal or distinctly produced mesad, with distal margin of production broadly arcuate or bisarcuate. .... 5
5. Size averaging smaller. Tegmina with marginal field relatively narrow, at widest point never equal to more than one-fourth of total width of tegmen; stigma broader, more oval. Pronotum with lateral margins of shaft in large part sub-parallel. Head in cephalic aspect more strongly transverse, eyes more globose; facial scutellum more strongly transverse. .... *carolina* (Johannson)
- Size averaging larger. Tegmina with marginal field distinctly broader, at widest point equal to not less than a third of total width of tegmen; stigma narrow, linear. Pronotum with lateral margins of shaft never straight, in middle always incurved to some degree. Head in cephalic aspect less transverse, more distinctly trigonal, eyes less globose; facial scutellum proportionately higher ..... 6
6. Head in cephalic aspect more equilateral. Pronotum more robust in build, with cephalic half distinctly and as a whole elongate elliptical in general outline; spination of lateral margins distinct and serrate but rather fine and numerous. Tegmina with apex broadly rounded. Cephalic limbs very robust. Cephalic coxae distinctly biserially dentate on flexor margin, but teeth never exceptionally robust or lamellate in character. .... *m. montana* Saussure and Zehntner
- Head in cephalic aspect with trigonal shape more depressed. Pronotum more slender, less robust, with cephalic half showing a distinct narrowing concavity of lateral margins cephalad of supra-coxal expansion; spination of lateral margins much larger and blunter but sparser. Tegmina with apex narrowly rounded acute. Cephalic limbs less robust. Cephalic coxae strongly biserially dentate on flexor margin, larger teeth exceptionally robust and lamellate in character. .... *theophila* Rehn
- Incertae sedis (adult female not known) ..... *parvidentata* Beier



**Stagmomantis parvidentata** (Beier).

*Stauromantis parvidentata* Beier, Mitteil. Zoolog. Staatsinst. u. Zool. Mus. Hamburg, XLV, p. 17, (1931), [♂; Las Mercedes, 150-300 meters, Limón Plain, Costa Rica].

Cachí. November 29, 1910. (C.H. Lankester.) One male.

Carrillo. (Underwood.) One immature female. [Hebard Cln.]

The original assignment of this apparently rare and local species to *Stauromantis* was caused by the marginal field of the type being hyaline with a broad white bar paralleling the humeral trunk, as is the usual condition in *S. theophila*, which is the genotype of Giglio-Tos' *Stauromantis*. As I have shown in the present paper, under the last mentioned species, the whitish band there found varies greatly in relative width, in fact so much that the marginal field can be predominatingly opaque.

The male from Cachí here referred to *parvidentata* is in the brown phase, while the previously unique type is in the green phase. The marginal field of the tegmina of the Cachí male is almost entirely opaque greenish white, and the wings, instead of being hyaline, as in the type, are markedly fusco-infumate everywhere except proximad in the discoidal field, the venation hyaline and thus in consequence making the infumation strikingly tessellate. This wing tone is probably correlated with the color phase represented by the specimen, which in all fundamental features other than those here mentioned agrees with Beier's description.

The conclusion I have drawn from the evidence immediately before me, taken with that presented by the available, often quite extensive series of other members of the genus, is, that in at least three of the species of *Stagmomantis* which have opaque barring in the marginal field of the male tegmina, the degree to which the same area may in large part become opaque varies individually, or possibly to a degree geographically, as suggested under *S. theophila*.

The relationship of *parvidentata* to *heterogamia* and *venusta* is clearly evident when the three species are compared. All agree in the general form, the basic pronotal features and the character of the cephalic limbs. The position of *parvidentata* is intermediate between *heterogamia* and *venusta*, the cross-veins of the discoidal field of the male tegmina showing (particularly mesad) a moderate amount of sigmoidal flexure, yet not so much as is evident in *venusta*. On the other hand the denticulations of the flexor margin of the cephalic coxae and of the lateral margins of the pronotum are more apparent and definite than in either of the other species.

The Cachí male lacks the apex of the abdomen and is somewhat smaller than Beier's original measurements, which is to be expected as Cachí is higher than the type locality (Las Mercedes), and probably a peripheral point in the species' distribution. The Carrillo female is in the instar preceding maturity.

In millimeters the present specimens measure as follows:

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Length of caudal femur
♂, Cachi .....	— <sup>126</sup>	15.3	2.6	35	9.1
Immat. ♀, Carrillo .....	38	16	3.19	—	10

Our entire knowledge of the distribution of the species is of its occurrence at Las Mercedes, Carrillo and Cachi, Costa Rica, between elevations of 500 and 3000 feet in the Atlantic Coast rain-forest region.

**Stagmomantis heterogamia** Saussure and Zehntner.

*Stagmomantis heterogamia* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 140, 142, pl. VII, figs. 2 and 3, (1894), [♂, ♀; Bugaba, 800-1500 feet elevation, Panama].—Rehn, Proc. U.S. Nat. Mus., XXVII, p. 563, (1904), [Tucurrique].—Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 341, (1923), [Porto Bello, Panama; Costa Rica].

Juan Viñas. March. One female. [Hebard Cln.]

Las Ánimas, Rio Reventazón.<sup>127</sup> April 18, 1930. (C. H. Lankester.) One male.

La Florida. (C. H. Lankester.) One male.

La Emilia, Guápiles District. Elevation, 1000 feet. August 15, 1923. (Rehn; swept from foliage in heavy primeval forest.) One female. September 15, 1927. (Rehn; swept from high green vegetation along margin of heavy second-growth forest.) One female, one immature female.

Vesta Farm, Estrella Valley. Elevation, 200 feet. September 13, 1923. (Rehn; in dense lowland forest.) One immature male.

Werner<sup>128</sup> has suggested the possibility of *heterogamia* being identical with *venusta*.<sup>129</sup> The latter species, however, is quite distinct and both sexes of it are now before me.<sup>130</sup> It has a number of features of difference from *heterogamia*, and as far as known does not inhabit the same territory as *heterogamia*.<sup>131</sup> In the male sex they can be separated at once by the feature given by Saussure and Zehntner, i. e. the normal transverse dis-

<sup>126</sup> Apex of abdomen missing.

<sup>127</sup> This locality is none of the three places by this name listed in Felix Noriega's "Diccionario Geográfico de Costa Rica" (1923). To quote a letter of April 24, 1930 from the collector, the name is here used for "the forest on and near an island in the Reventazón just below Turrialba." This would be at an elevation of about 500 meters, in the humid Atlantic portion of the Tropical Zone.

<sup>128</sup> Konowia, IV, p. 165, (1925).

<sup>129</sup> Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 141, 145, pl. VII, figs. 4 and 5, (1894), [♂, ♀; Sinanja, Panima and Teleman, Vera Paz, Guatemala].

<sup>130</sup> Columbia, British Honduras; March, 1932; (J. J. White); one male; [Hebard Cln.]. Punta Gorda, British Honduras; March, 1931; (J. J. White); one male; [Hebard Cln.]. Lancetilla, Atlantida, Honduras; August 27-September 4, 1930; (Rehn); one male, two females.

<sup>131</sup> The record of *venusta* from the Surubres River at San Mateo, Costa Rica, published by me in 1906 (Proc. Acad. Nat. Sci. Phila., 1905, p. 794) refers to the then undescribed *S. centralis*, under which species this record is properly placed.

position of the cross-veins of the discoidal field of the tegmina, while in *venusta* these veins are longitudinally sigmoid to a marked degree. In the female sex the more thickly spined lateral pronotal margins, somewhat heavier cephalic limbs, more heavily scabrose cephalic coxae and distinctly longer tegmina, with an evenly wide marginal field, and a tendency toward the same disposition of the tegminal cross-veins seen in the male, will readily separate *venusta* from *heterogamia*.

The three adults of each sex of *heterogamia* now before me show almost no noteworthy variation in size or color. The male from Tucurrique and the female from Juan Viñas are slightly smaller than those of the respective sexes from lower elevations, which is to be expected, and is evident in numerous other instances.

The localities given in the above references and for the material here reported present the entire known range of the species, which is thus seen to occur in both eastern and western Panama on the coast (Porto Bello) or at but moderate elevations (Bugaba, 800-1500 feet), and in eastern Costa Rica to as high as Juan Viñas (3030 feet), which is at the upper limit of distribution of many other lowland tropical forest species. It is thus seen to be essentially a rain-forest species, and doubtless will be found to range northward into similar country in eastern Nicaragua, and probably south and east to the Gulf of Darien district of Colombia.

Personally I have always taken *heterogamia* on the foliage of forest undergrowth, either in very heavy stands of uncut forest or in the marginal screen of dense second-growth rain-forest areas.

Our information on periodicity is not extensive. It is known to occur adult from March (Juan Viñas) to mid-September (La Emilia, September 15), but immature material taken on the last mentioned date indicates certain individuals are then not fully adult. Perhaps it is two-brooded.

**Stagmomantis nahua** Saussure. Plate 7, figures 14 and 15.

*St[agmomantis] nahua* Saussure, Mittheil. Schweiz. Entom. Gesell., III, p. 65, (1869), [♂, ♀; Mexico<sup>132</sup>].—Pittier, Anales Inst. Fisico-Geograf. y Mus. Nac. Costa Rica, III, p. 115, (1892), [♂; San José].—Rehn, Proc. U. S. Nat. Mus., XXVII, p. 563, (1904), [♂; San José].—Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 794, (1906), [♂, ♀; Carrillo].—Giglio-Tos, Das Tierreich, Lief. 50, p. 387, (1927), [Costa Rica].

San José, November, 1906. (P. Biolley.) Two males, one female.

Monte Redondo.<sup>133</sup> April, 1903. (Underwood.) One immature female. [Hebard Cln.]

Las Concévas, near Dulce Nombre. August 12, 1919. (C. H. Lankester.) One male.

<sup>132</sup> When next discussing the species Saussure (Mém. Hist. Nat. Mex., IV (Synop. Mant. Amér.), pp. 45-46, (1871)) gave as the localities for *nahua* "Le Mexique; région orientale. Orizaba, Cordoba. 7 ♀ 11 ♂, in copula.")

<sup>133</sup> See footnote number 49 under *Oligonicella striolata*.

In addition to the specimens here listed I have before me the male and female from Carrillo previously recorded, and a paratypic male and a paratypic female, taken at Orizaba, Mexico by Sumichrast, and received by the Hebard Collection in exchange from the Geneva Museum. The evidence of this pair of the original material verifies my previous determination of the species.

The available series of five adult males and three adult females exhibits some noteworthy variation. The Orizaba male is somewhat discolored and washed with brownish, but all of the others of that sex and the females are of a green color phase. The first mentioned male has the pale orange internal face of the cephalic femora washed with fuscous, both proximad and distad of the groove, while the Costa Rican males show no indication of this. The Orizaba female has in the same area a small circular dot of fuscous immediately cephalad of the groove, while the Costa Rican females lack all trace of this dot. Apparently the presence, or emphasis when present, of fuscous on this surface is correlated with the general color tone.

In size we find the San José males of approximately equal size to that from Orizaba, while those from Carrillo and Las Cóncevas are very distinctly smaller. The Costa Rican (San José and Carrillo) females are, however, of virtually equal size and very similar to that from Orizaba. For the assistance of other students the measurements of the adults now before me are as follows:

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Length of caudal femur
♂, Orizaba, Mexico, <i>paratype</i> ....	38 <sup>134</sup>	13.7	2.77	19	9.2
♂, San José, Costa Rica .....	38	11.6	2.52	21.7	8.3
♂, San José, Costa Rica .....	39	12.2	2.52	23.5	8.4
♂, Las Cóncevas, Costa Rica ....	35.3	10.8	2.1	20	7.5
♂, Carrillo, Costa Rica .....	36.2 <sup>134</sup>	11.9	1.99	22	8.3
♀, Orizaba, Mexico, <i>paratype</i> ....	43.5	16.5	3.86	10.3	11.8
♀, San José, Costa Rica .....	41.8	14	3.44	8.6	10.1
♀, Carrillo, Costa Rica .....	42.6	15	3.61	10.3	11

Within Costa Rica the species occurs in the central tableland and down into the lower eastern tropical forest area as far as Carrillo. However, the specimens labelled "Carrillo" may have been taken at a distinctly higher elevation, as the now largely abandoned cart-road which from San José led over the pass of La Palma (5000 feet) dropped down some thousands of feet along the steep valley of the Rio Hondura, and terminated at the now non-existent settlement of Carrillo. A matter of a few miles from Carrillo toward La Palma along this old highway produces a marked difference in life condition. Outside of Costa Rica we know the species only from southern Mexico and Darien, Panama.<sup>135</sup>

<sup>134</sup> Body somewhat flexed, actual length slightly greater.

<sup>135</sup> Vide Giglio-Tos, Das Tierreich, Lief. 50, p. 387, (1927). This latter record quite possibly may refer to some one of the other related species.

In Costa Rica *heterogamia* is seen to occur adult from mid-August to November, while it is known to be in the instar preceding maturity in April.

**Stagmomantis vicina** Saussure. Plate 7, figures 16 and 17.

*St[agmomantis] vicina* Saussure, Mitth. Schweiz. Entom. Gesell., III, p. 229, (1870), (♂; "America meridional," in 1872 (Miss. Sci. Mexiq., Rech. Zool., VI, p. 245) given as Guatemala).

Oricuajo,<sup>136</sup> Rio Jesús Maria. Elevation, 225-250 feet. September 1, 1927. (Tristán and Rehn.) One female.

This specimen has been compared with three males and four females of the species from Honduras and British Honduras,<sup>137</sup> and no noteworthy features of difference are evident. The series of females shows some little individual size variation, and the dimensions, while essentially as given by Saussure in 1872,<sup>138</sup> are appreciably different from those of that sex cited by Giglio-Tos.<sup>139</sup> I cannot help suspecting that the latter student took his measurements of the male from Saussure's writings and those of the female from the individual which he has recorded from "Florida," a region where *vicina* and its intimate relatives certainly do not occur, as the knowledge gained by years of intensive field work in that state by American orthopterists testifies. The whole eastern United States possesses but two species of *Stagmomantis*, i. e. *S. carolina* and *floridensis*. In addition the specimen then before him probably does not represent *vicina*, as its dimensions do not agree with either the Saussurean measurements or those of the present series, the body being too long and the pronotum too short.

The Oricuajo female and the Cantarranas extremes of that sex, as well as the males now in hand, measure (in millimeters) as follows:

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Length of caudal femur
♂, Punta Gorda, British Honduras	40	12	2.52	25.3	9
♂, Cantarranas, Honduras	40.6	11.9	2.26	25.2	8.5
♂, Cantarranas, Honduras	43.2	12.3	2.35	26.5	8.2
♀, Cantarranas, Honduras	41.8	13.5	3.10	9	10.2
♀, Cantarranas, Honduras	40	12.5	2.85	8.1	9.4
♀, Oricuajo, Costa Rica	39.7	14	2.91	8.8	9.5

When compared with *nahua* the present species in both sexes is seen to be more delicate, with a narrower head, and more slender, less supra-coxally expanded pronotum, the latter also having less strongly denticulate lateral margins. In the male sex the left ventral valve has its aciculate extremity

<sup>136</sup> See footnote number 15 under *Musonia surinama*.

<sup>137</sup> Cantarranas, Rio Choluteca, Honduras; elevation, 2200 feet; August 5, 6 and 9, 1930; (Rehn); two males, four females. Punta Gorda, British Honduras; November, 1930; (J. J. White); one male; [Hebard Cln.].

<sup>138</sup> Vide supra.

<sup>139</sup> Das Tierreich, Lief. 50, p. 388, (1927).

much more attenuate and prolonged, and its flexure much sharper, than in *nahua*.

The internal face of the cephalic femora may bear one or two black dots placed proximad and distad of the groove, or one or both may be absent, while their indication is sometimes of the faintest character.

The authentic information now available shows that the species occurs in the extreme southern part of British Honduras (Punta Gorda), Guatemala (exact section not known), in the semi-arid valleys of western Honduras (Cantarranas), and a very similar type of environment near the western coast of Costa Rica (Oricuajo).<sup>140</sup> Apparently within the latter country its range is not extensive, but may extend over a considerable section of the Pacific slope.

The Oricuajo specimen was swept from vegetation along the track of the Pacific Railway. The Cantarranas males all came to light at night; the females were all swept from foliage along roads in rather dry potreros (pastures) and near agave hedges.

***Stagmomantis centralis*** Giglio-Tos. Plate 7, figures 18 and 19; plate 9, figure 7.

*Stagmomantis venusta* Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 794, (1906), [♂; Surubres River at San Mateo, Costa Rica], (Not *S. venusta* Saussure and Zehntner).

*U[romantis] centralis* Giglio-Tos, Bull. Soc. Entom. Ital., XLVIII, p. 57, (1917), [♂; S[an] Mateo, Costa Rica].—Giglio-Tos, Das Tierreich, Lief. 50, pp. 388, 389, (1927), [Costa Rica].

*U[romantis] similis* Giglio-Tos, Bull. Soc. Entom. Ital., XLVIII, p. 57, (1917), [♂; S[an] Mateo, Costa Rica].—Giglio-Tos, Das Tierreich, Lief. 50, pp. 388, 389, (1927), [Costa Rica].

*Stagmomantis vicina* Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 342, (1923), [Costa Rica], (Not *S. vicina* Saussure).

Cerro las Pilas, near Santa Cruz, Nicoya Peninsula. January 21, 1910. (Calvert.) One male.

San Lucas Island, Gulf of Nicoya. January 15, 1930. (M. Valerio.) One male.

Las Cañas,<sup>141</sup> Guanacaste. June 8, 1923. One female.

Oricuajo,<sup>142</sup> Rio Jesús Maria, elevation 225-250 feet. August 31 and September 2, 1927. (Tristán and Rehn; beaten from tree foliage in open potreros.) Two females.

Orotina. October 10, 1915. (A. Alfaro.) One male.

Atenas. May 7 and 9, 1916. (A. Alfaro.) One male, two females, one immature male.

Chara. November 23, 1915. (A. Alfaro.) One immature male.

<sup>140</sup> Hebard's records of the species from Panama and Oaxaca, Mexico (Trans. Amer. Entom. Soc., XLVIII, p. 342, (1923) and LVIII, p. 212, (1932)) refer to *S. centralis*, which see. This confusion was due to true *vicina* not being available in 1923. As shown above I question whether Giglio-Tos ever saw material of the present species.

<sup>141</sup> See footnote number 94 under *Melliera chorotega*.

<sup>142</sup> See footnote number 15 under *Musonia surinama*.

Ciruelas. November 23, 1915. (A. Alfaro.) Two males, two females.

The apparently jumbled references given above need a few words of explanation. One of the chief reasons for the misidentification of this species by Rehn and Hebard was that neither had before them true *venusta* or *vicina* at the time they were writing. Both of these species are now before me and their characters and positions are clearly evident. I am not at all certain the material referred to these species by Giglio-Tos in his monograph<sup>143</sup> was in all cases correctly determined, in fact I am much inclined to doubt it. Hebard in 1923<sup>144</sup> considered *centralis* and *similis* to equal *vicina*. All the material then before him represented a single species, which, however, was not *vicina*, but the one for which the first name proposed is *centralis*. Giglio-Tos beclouded the whole situation by dogmatically aligning his *centralis* and *similis* with *heterogamia* and *venusta*, to which latter two the present species is not intimately related, instead of with *nahua* and *vicina* its nearest allies. This was done solely on account of the opacity of the marginal field of the male tegmina, which is a useful but far less fundamental feature than he supposed. The synonymy of *similis* and *centralis*, as pointed out by Hebard, is beyond question, the former name having been established on very slightly larger, paler colored male individuals from the same locality as the type material of *centralis*. The present series conclusively demonstrates the correctness of this synonymy.

This species, under the name *vicina*, was compared with *S. nahua* by Hebard,<sup>145</sup> and it is unnecessary to repeat his comparative remarks or those concerning the two well-marked color phases of the species. By inadvertence he used the word "proximad" instead of "distad" in giving the extent of the brown pencilling of the interval between the discoidal and median veins of the tegmina. The present series shows the internal face of the cephalic femora may have no trace at all of paired black dots bordering the groove, or these may be well developed, or in the most intensive condition, as stated by Hebard, they may even unite and completely suffuse the whole internal surface of the femora. These spots are more frequently absent in the green phase than in the brown, and the heavily suffused type has been seen only in the latter condition.

The adult series of *centralis* now before me comprises twenty-four males and twelve females, of which fourteen males and two females represent the brown phase and ten males and ten females the green phase.

In size both sexes show a very great amount of individual variation. From merely a few specimens representing widely scattered localities one

<sup>143</sup> Das Tierreich, Lief. 50, pp. 387-388, (1927).

<sup>144</sup> Vide supra.

<sup>145</sup> Trans. Amer. Entom. Soc., XLVIII, pp. 342-343, (1923).

might assume this to be geographic, but present evidence shows such is not the case. The following measurements (in millimeters) demonstrate the individuality of this variation.

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Length of cephalic femur
♂, Almoloyas, Oaxaca, Mexico . . . .	42	14	2.77	28	10
♂, Almoloyas, Oaxaca, Mexico . . . .	48	13.5	2.85	28.3	10.3
♂, Surubres River at San Mateo, Costa Rica (topotypic) . . . . .	46	14	3.19	29	9.6
♂, Atenas, Costa Rica . . . . .	38.4	11	2.26	23.8	8.2
♂, La Chorrera, Panama . . . . .	38	12.4	2.26	24.3	8.3
♂, Balboa, Canal Zone . . . . .	40.4	14	2.52	26	9.5
♀, Almoloyas, Oaxaca, Mexico . . . .	50.5	16	4.03	12.4	12.4
♀, Almoloyas, Oaxaca, Mexico . . . .	58	19.5	4.2	14.2	14
♀, Las Cañas, Costa Rica . . . . .	40 <sup>146</sup>	—	3.1	10.2	— <sup>147</sup>
♀, Oricuajo, Costa Rica . . . . .	45	15	3.19	11	10.8
♀, Oricuajo, Costa Rica . . . . .	49	15.7	3.52	11	11.4
♀, Atenas, Costa Rica . . . . .	45.5	15	3.52	10.8	11.2
♀, Ciruelas, Costa Rica . . . . .	53	20	4.36	13	13.9

The distribution of *centralis* covers an extensive area reaching from the State of Oaxaca, southern Mexico (Almoloyas<sup>148</sup>) southward across eastern Nicaragua (Chinandega<sup>149</sup>) and eastern Costa Rica to the Pacific side of the Isthmus of Panama (La Chorrera, Corozal, Paraiso, Ancon, Balboa and Taboga Island<sup>150</sup>). Whether it ranges beyond into Colombia we do not know, but from the character of its preferred habitat I should much question its occurrence in the far more humid areas of Colombia nearest to Panama. In Costa Rica, from available information, *centralis* is limited to the Pacific slope, its range extending from sea-level to at least as high as Ciruelas, at an elevation of approximately two thousand feet.

It is evident this insect prefers a savannah type of country, relatively rainless in the dry season, with extensive grassland and park-like disposition of the rather open tree cover. This, at least, is the environment found at the Costa Rican and Panamanian localities from which it is known. From present information the foliage of trees, and possibly shrubby cover, is the favorite habitat of the females.

*Centralis* occurs in the adult condition through most of the year, the Costa Rican series alone containing adults taken in January, May, June, August, September, October, and November. It thus is found adult in both the wet and dry seasons.

<sup>146</sup> Estimated-pronotum damaged caudad.

<sup>147</sup> Lacking.

<sup>148</sup> See Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 342, (1923).

<sup>149</sup> (F. C. Baker); one female.

<sup>150</sup> Reported by Hebard, Trans. Amer. Entom. Soc., LVIII, p. 212, (1932) as *vicina*.



**Stagmomantis carolina** (Johannson). Plate 7, figures 20 and 21; plate 10, figures 1 and 2.

*Gryllus carolinus* Johannson, in Linnaeus, Amoen. Acad., VI, p. 396, (1763), [♀; Carolina].

[*Mantis*] *gemma* Stoll, Natuur. Afbeeld. Beschr. Spoken, etc., pp. 71, 78, pl. XXIV, fig. 92, (1813), [♀; Georgia ("Nouvelle Georgie") or Virginia].

*Mantis inquinata* Serville, Hist. Nat. Ins., Orth., p. 191, (1839), [♂ (?); South Carolina].<sup>151</sup>

*M[antis]* *ferox* Saussure, Revue et Magasin de Zool., (2) XI, p. 60, (1859), [♀; Carolina and Mexico].<sup>152</sup>

*Mantis (Stagmatoptera) tolteca* Saussure, Revue et Magasin de Zool., (2) XIII, p. 127, (1861), [♀ (but not stated); "Mexico calida"].<sup>153</sup>

*St[agmomantis]* *stollii* Saussure, Mitth. Schw. Entom. Gesell., III, p. 65, (1869), [Based solely on the female figured by Stoll (pl. XXIV, fig. 92) from Georgia ("Nouvelle Georgie") or Virginia].<sup>154</sup>—Giglio-Tos, Das Tierreich, Lief. 50, pp. 379, 381, (1927), [♀; Texas].

*Stagmomantis dimidiata* Saussure, Mém. Hist. Nat. Mex., 4, (Syn. Mant. Amér.), pp. 44, 48, (1871), [Not *Mantis dimidiata* Burmeister], (Combination only).<sup>155</sup>—Pittier, Anales Inst. Fisico-Geográfico y Mus. Nac. Costa Rica, III, p. 115, (1892), [San José, Costa Rica].—Saussure and Zehntner, Biol. Cent.-Amer., Orth., 1, pp. 140, 145, (1894), [Many localities including San José].—Tristán Informe Mus. Nac. Costa Rica, 1896, p. 15, (1896), [San José].—Tristán, Insectos de Costa Rica, p. 21, (1897), [Guatitil de Pirris].—Rehn, Proc. U. S. Nat. Mus., XXVII, p. 564, (1904), [San José].

*Stagmomantis tolteca* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 140, 143, (1894), [Many localities including Costa Rica].—Tristán, Informe Mus. Nac. Costa Rica, 1896, p. 15, (1896), [Turrijal].—Rehn, Proc. U. S. Nat. Mus., XXVII, p. 564, (1904), [Piedras Negras and Turrijal].—Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 794, (1906), [Surubres River at San Mateo].

*Mantis wheeleri* Thomas, Rep. Expl. W. 100th Merid., V, p. 849, (1975), [♀; Western United States, exact locality not stated].<sup>156</sup>

*Bactromantis virga* Seudder, Canad. Entom., XXVIII, p. 213, (1897), [juv. ♂ (not ♀); Sanford, Florida].<sup>157</sup>

*Leptocoe thoracica* Rehn, Genera Insectorum, Orth., Mantidae, Vatinæ (fasc. 119), p. 11, (1911), [♀; Culata, Venezuela].

*Leptocoe maculosa* Chopard, Bull. Soc. Entom. France, 1912, p. 104, fig. 1, (1912), [♀; Nicaragua].<sup>158</sup>

*S[tagmomantis]* *nordica* Giglio-Tos, Bull. Soc. Entom. Ital., XLVIII, p. 53, (1917), [♂, ♀; Virginia; Baltimore [Maryland]].—Giglio-Tos, Das Tierreich, Lief. 50, pp. 379-380, (1927).<sup>159</sup>

*S[tagmomantis]* *polita* Giglio-Tos, Bull. Soc. Entom. Ital., XLVIII, p. 53, (1917), [♂, ♀; Nicaragua; British Guiana].<sup>160</sup>—Giglio-Tos, Das Tierreich, Lief. 50, pp. 379, 381, (1927).

*S[tagmomantis]* *simplex* Giglio-Tos, Bull. Soc. Entom. Ital., XLVIII, p. 54, (1917), [♂, ♀; Mexico; Texas].<sup>161</sup>—Giglio-Tos, Das Tierreich, Lief. 50, pp. 379, 381, (1927).

*St[agmomantis]* *carolina* Werner, Konowia, IV, p. 160, (1925), [Costa Rica; San José].

<sup>151-154</sup> Synonymy established by Seudder, Proc. Davenp. Acad. Nat. Sci., VIII, p. 12, (1900).

<sup>155</sup> Reference correctly assigned by Werner, Konowia, IV, p. 160, (1925).

<sup>156</sup> Synonymy established by Seudder, Proc. Davenp. Acad. Nat. Sci., VIII, p. 12, (1900).

<sup>157</sup> Synonymy established by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1916, pp. 121-122, (1916).

<sup>158</sup> Synonymy established by Chopard, Bull. Soc. Entom. France, 1912, p. 394, (1912).

<sup>159-161</sup> Synonymy established by Werner, Konowia, IV, p. 161, (1925).

*S[tagmomantis] latipennis* Giglio-Tos, Das Tierreich, Lief. 50, pp. 379-380, (1927), [Not *Mantis* (*Stagmatoptera*) *latipennis* Burmeister], [♂, ♀; Mexico; Costa Rica; Nicaragua].

*S[tagmomantis] inquinata* Giglio-Tos, Das Tierreich, Lief. 50, pp. 379-380, (1927), [♂, ♀; Mexico; Nicaragua; Costa Rica].

*S[tagmomantis] ferox* Giglio-Tos, Das Tierreich, Lief. 50, pp. 379, 381, (1927) [♂, ♀; Mexico; Costa Rica].

The synonymy given above is supplementary to that placed under *carolina* by Giglio-Tos in his treatment of the latter in the Tierreich monograph.<sup>162</sup> The synonymy of *Leptococe thoracica* is here first established, the unique type being a female minus the apex of the abdomen and in consequence the pronotum appears unduly elongate. It is in all respects typical *Stagmomantis carolina*, the caudal tibial carination, which caused its reference to the Vatinæ, being no more emphasized than in most individuals of the species.

Gulf of Nicoya. One male. [Hebard Cln.]

Puntarenas. November 4, 1915. (A. Alfaro; at electric light.) One male.

San Lucas, near mouth of Rio Jesús Maria. Elevation, 10 meters. January 15, 1930. (M. Valerio.) One female.

Surubres. Elevation, 250 meters. February, 1905. (P. Biolley.) One male.

Orotina. July 18, 1915. (A. Alfaro.) One male.

Atenas. May 7, 1916. (A. Alfaro.) One female.

Ciruelas. November 23, 1915. (A. Alfaro.) One male.

Alajuela. August 6, 1915. (A. Alfaro.) One female.

Corralillo, Volcan de Irazú. March, 1924. (J. F. Tristán.) One male.

San José. Elevation, 1160 meters. January 3 and 6, June 1, 1929. (M. Valerio.) Three males, four females. October 4, 1902. (Underwood.) Three females. [Hebard Cln.] (P. Biolley.) One male. [Hebard Cln. ex Geneva Mus.] (J. F. Tristán.) One female.

Monte Redondo.<sup>163</sup> March 30, 1895. (Underwood.) One male. [Hebard Cln.]

Agua Caliente. December 8, 1919. (C. H. Lankester.) One male.

Cachí. March 10, 1910. (P. P. Calvert; indoors.) One male. (C. H. Lankester.) One female.

Guápiles. Elevation, 984 feet. August 14, 1923. (Rehn; on wall at night.) One male.

Rio Toro Amarillo, west of Guápiles. Elevation, 1000 feet. August 19, 1923. (Rehn; swept from weedy growth in river bottom.) One immature female.

La Florida, Rio Reventazón. (C. H. Lankester.) One male.

<sup>162</sup> Das Tierreich, Lief. 50, p. 379, (1927).

<sup>163</sup> See footnote 49 under *Oligonicella striolata*.

North end of Suretka Trail, along Duroy River, Estrella Valley. Elevation about 100 to 150 feet. September 8, 1927. (Rehn; beaten from brush in heavy forest.) One male.

The artificial and purely mechanical character of Giglio-Tos' specific discriminations in his Tierreich monograph can hardly be illustrated better than by his treatment of the forms belonging to the genus *Stagmomantis* as he restricts it.<sup>164</sup> Thirteen "species" are there treated as distinct and valid, entirely on the basis of color characters or minor and fluctuating structural features. Of the thirteen so recognized, nine as there understood are nothing more than color phases or individual variants of *Stagmomantis carolina*, three of the names so used really have no bearing on the phase to which they are there assigned, and one other (*coerulans*) is probably only an additional color phase of the same widely distributed and exceedingly variable species. Of the nine names considered representative of valid species six had been placed in the synonymy by previous authors, and two others were clearly based on opposite sexes of a species of a quite different genus of southern South America, which does not range into the territory in which *Stagmomantis*, even in its broadest sense, occurs.

The synonymy here set forth is self-explanatory when taken with the footnotes to the same, and needs no further discussion. It, however, represents conclusions independently reached by me after full examination of the literature and a series of *carolina* comprising, in addition to the material here reported, 304 specimens (191 males, 113 females) in the Philadelphia collections, these covering the entire known range of the species. As much of this material comes from areas beyond the territory covered by the present study, I am not presenting in elaborate detail the evidence on which my conclusions as to the correctness of the above synonymy have been based. I have, however, summarized as briefly as possible the information thus accumulated on the plasticity and variability of *carolina*.

Werner<sup>165</sup> has already discussed the color phases of *carolina*, but the localities cited by him for certain of his material show with little question that he had before him representatives of distinct species of the genus, one state (Nevada) cited not being inhabited by *carolina*, which in reality has a very restricted range in the Western United States, as shown by extensive collections and field studies extending over twenty years made by Mr. Hebard and the author.

The great range of individual size variation in *carolina* often found at single localities, as well as that at different localities in the same general regions, can well be shown by the following measurements of extremes or others from Central and South American series now before me:

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<sup>164</sup> Das Tierreich, Lief. 50, pp. 378-383, (1927).

<sup>165</sup> Konowia, IV, pp. 160-163, (1925).

	Length of body	Length of pronotum	Length of tegmen	Length of cephalic femur
♂				
Santa Isabel, Chiapas, Mexico <sup>166</sup> .....	58.7	18	40	11.2
Santa Emilia Pochuta, Guatemala <sup>167</sup> .....	58	18.8	38.5	10.8
Morales, Guatemala <sup>168</sup> .....	— <sup>169</sup>	18	36.5	11
Morales, Guatemala <sup>168</sup> .....	70	22	44	13.6
Rio Grande Br. Honduras <sup>170</sup> .....	57.3	18.5	36	10.7
Rio Grande, Br. Honduras <sup>170</sup> .....	62.6	21.3	40.3	12.5
Eden, Nicaragua <sup>171</sup> .....	54.5	17.2	36	11.2
Eden, Nicaragua <sup>171</sup> .....	63	19.6	38.9	12.7
San José, Costa Rica .....	59.3	19	43	12.5
San José, Costa Rica .....	59.6	20	44.8	11.8
Puntarenas, Costa Rica .....	61.3	19.6	40.5	11.9
Corralillo, Costa Rica .....	57.8	18.3	41.5	11.5
Monte Redondo, Costa Rica .....	57	19	43	10.8
Guápiles, Costa Rica .....	56	18.9	35.7	11.2
La Florida, Costa Rica .....	— <sup>174</sup>	20.5	42	12.1
Fyzabad, Trinidad <sup>172</sup> .....	57.4	18.3	35.4	11.1
Fyzabad, Trinidad <sup>172</sup> .....	70	23	41	14
♀				
Orizaba, Vera Cruz, Mexico <sup>173</sup> .....	56	23	22.5	14.5
San José, Costa Rica .....	52	20	24	14
San José, Costa Rica .....	62	21.5	26.9	15.8
San José, Costa Rica .....	— <sup>174</sup>	23.5	26.8	15.8
San Lucas, Costa Rica .....	63	25	27.5	17
Atenas, Costa Rica .....	55.5	20.7	25	14
Cachi, Costa Rica .....	62	24.5	28.2	16
San Feliz, Panama <sup>175</sup> .....	62.5	24	26	15.5

The measurements given above cover, for almost all of the features, as broad a range of size variation as presented by Giglio-Tos in the diagnoses of the various so-called "species", except that his *carolina* and *nordica* measurements average smaller. This would be expected, as they were based on North American material, which averages of lesser bulk than the Central American individuals here considered, a tendency well shown by the wide-ranging series now before me. Apropos of this the previously

<sup>166</sup> November 17, 1930; (A. Dampf); 1 ♂; [Hebard Cln.].

<sup>167</sup> Elevation, 1000 meters; February-March, 1931; (J. Bequaert); 1 ♂.

<sup>168</sup> Extremes of thirty-nine males. September, 1930; (J. J. White); [Hebard Cln.].

<sup>169</sup> Apex of abdomen lacking.

<sup>170</sup> Extremes of four males. February and March, 1932; September, 1931; (J. J. White); [Hebard Cln.].

<sup>171</sup> Extremes of twenty-three males. March 31, May 1, 18, 26, 28 and June 4, 1922; (Wharton Huber); 10 ♂. August 18 and 28, 1922; (J. S. Mackenzie); 13 ♂.

<sup>172</sup> Extremes of thirteen males. March 8, April, May 8, June, July 7, August 2 and 30, October, 1929; February 13, September 17, October 24, November 7 and 14, December 1, 1928; (N. A. Wood); [Hebard Cln.].

<sup>173</sup> (Sumichrast); [Hebard Cln. ex Geneva Museum]; determined and labelled as *dimidiata* by Saussure (vide Biol. Cent.-Amer., Orth., I, p. 144).

<sup>174</sup> Apex of abdomen missing.

<sup>175</sup> (Champion); [Hebard Cln. ex Geneva Museum]; determined and recorded as *tolteca* by Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 143-144.

published minima of North American individuals of both sexes<sup>176</sup> are appreciably smaller than the minima of the above mentioned measurements of Giglio-Tos. An analysis of the size variation found in the extensive series of the species from North America cannot be presented here, but it suffices to say that the present comments as to size and proportional variation are amply supported by the extensive material from that portion of the species' range.

In series of *carolina* of any size, but more distinctly in the female sex, there will be found a very appreciable amount of individual fluctuation in the relative thickness and consequent outline of the metazonal portion of the pronotum. With this will be noticed variation in the proportional, and actual, length of the same area, when compared with that of the prozonal section, and consequently of the whole pronotum as well. The series of San José females exhibits this to a most amazing degree, so much so that the pronota alone of the extremes might be considered to represent different species, if the connecting intermediates, and the evidence of the other structural features, were ignored. The ocular emphasis of the supra-coxal expansion is largely influenced by the extent to which the metazona is compressed, as those individuals with nearly straight and subparallel lateral pronotal margins appear to have less evident expansions, while the more compressed metazona gives greater prominence to the supra-coxal dilations. It is very difficult statistically to present proof of this, influenced as such tendencies are by the marked variation in simple pronotal length, which is shown quite clearly by the measurements given above.

Werner<sup>177</sup> has endeavored to show that the color phases, or "varieties" as he terms them, of *carolina* can be grouped under five general headings, which he briefly diagnoses and in an explanatory fashion endeavors to correlate with various names which previously had been proposed. Unfortunately neither Giglio-Tos nor Werner have examined an important, yet much earlier, study which deals in part with the coloration of *Stagmomantis carolina*. This is entitled "The Biology of *Stagmomantis carolina*", by Phil and Nellie Rau.<sup>178</sup> The sections on color and color change in this memoir<sup>179</sup> should be read by all students working on the systematics of the mantids. A brief summary of their general findings on the present species' coloration<sup>180</sup> is as follows: "In the adult females . . . the wings (i. e. tegmina) are green, yellow or one of a variety of shades of gray, or mottled.

<sup>176</sup> Blatchley, Orth. N.E. Amer., p. 118, (1920).

<sup>177</sup> Konowia, IV, pp. 160-163, (1925).

<sup>178</sup> Trans. Acad. Sci. St. Louis, XXII, pp. 1-58, pls. I-XVII, (1913).

<sup>179</sup> Idem, pp. 23-28.

<sup>180</sup> Based on "three summers' observations on the biology of a good many hundreds of living insects". The specimens used were from the general vicinity of St. Louis, Missouri, where but a single species of the genus, i. e. *carolina*, is known to occur.

Sometimes we find a brown adult female with green wings and sometimes a green one with brown wings. The males do not exhibit such a marked variety of color, but are usually extremely dark and the wings mottled, although a good many of them have green legs, and occasionally one occurs with green body, head and appendages, but never yet has a male been found with green wings. In some of the males the wings are hyaline, but observation has shown that this condition usually exists for a short time after moulting and before the pigment is distributed. In many the two pairs of hind legs seem to acquire the darker color before the front ones do; many are seen with the hind legs dark gray while the front pair are still green. These are always in contact with the material on which the insect rests, the dull, dark bark of trees, etc., while the front ones are held high in the air."

Similarly the observations of the Raus under their color change section<sup>181</sup> indicate that, in addition to a change in coloration in the growing nymphs, the coloration of the exposed portions of the bodies of fully adult females has been found to change, and to simulate the color tone of their environment.

Summarizing the evidence of the material before me, and giving due credit to the work of the Raus, it seems clear that the coloration of the normally exposed portions of the body varies independently of that of the concealed hind wings in the female; that the former is developed or moves basically with the fundamental green and brown color phase tendency of the mantids and many other Orthoptera; that in addition the general tone of the normally exposed surfaces of the body is in all probability equally independent of the exact pattern or contrast of the same surfaces. The inference which I am able to draw from the evidence now available is that the pattern and tone of the hind wings in the female are hereditary and genetically controlled, and that certain definite factors exist in this respect for normal yellow on the axillary base and on the discoidal field, for red brown and for yellow brown on the discoidal field, for emphasis of peripheral cross yellow or whitish nervures, for a dark apical spot on the discoidal field and possibly for a violet blue-black suffusion. The emphasis of the stigma of the tegmina, and possibly the blotched pattern of the whole tegmen in the brown phase, may also be genetic, as well as the frequent barring of the limbs, which as far as the cephalic pair are concerned may be independent of the general coloration of the median and caudal ones. It is very probable that basically the general color tone has a physiological control, such as we now know exists in the case of the acridid *Chortophaga*, and doubtless in the great number of similar cases of dichromatism in the Orthoptera.

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<sup>181</sup> Idem, pp. 26-28.

As to the adjustment of the general color tone to that of the environment discussed by the Raus, again we may have a physiological control, but independent of the moults. Such an arrangement would have a definite protective value in the life of the insect. Here, however, only the evidence of further careful experimental or similar studies will be conclusive.

As for the color evidence of the Costa Rican material now before me, the series of San José females (8) exhibits both green and brown marked phases, while the four males range from a pale buffy tone to a heavily infusate type. The San Lucas female is of a very dark brown phase, while the Atenas, Alajuela and Cachi females are markedly green phase. The La Florida male is in a pronounced green phase of body coloration, which is approached in varying degrees by the Puntarenas, Orotina, Ciruelas, Agua Caliente and Cachi males. The other males are of a definite brown phase, rarely with greenish on the legs (Estrella Valley).

In distribution *carolina* is now known to have a very considerable range, extending from the eastern and southern United States south to northern South America, but not occurring in the West Indies nor most of the western United States. In greater detail the area of regular distribution to the northward can be defined as north to extreme southern Pennsylvania, central Ohio, central Indiana, southern Illinois, Missouri, Kansas (probably in western part only in limited areas along more sheltered river valleys), extreme southeastern Nebraska,<sup>182</sup> eastern Colorado, but solely along the Arkansas River valley and west as far as Canyon City, extreme southern (Las Cruces) and eastern New Mexico,<sup>183</sup> and most if not all of Texas in suitable environments. All previous records from New Mexico, Arizona, Utah, Nevada and California will require careful re-examination of the material, as in some cases at least they clearly refer to other species of the genus. The records from Cuba, Jamaica, and Hispaniola, all relate to *Isomantis domingensis*, as available extensive West Indian material shows. The two forms are subject to confusion on superficial examination. In Mexico *carolina* as far as known is not found in the northwestern portion,<sup>184</sup> but except at high elevations is probably generally distributed in the eastern and southern portions. The records for Cuernavaca, Oaxaca, and Guadalajara, cited by Werner,<sup>185</sup> may or may not be correct, as that author has clearly erred in his reference of certain United States material

<sup>182</sup> Wymore, Gage County, Nebraska, (E. C. Goubbs), 1 ♂, [Hebard Cln.I.—Union, Cass County, Nebraska, 1909, 1 ♀, [Hebard Cln.I.—Lincoln, Lancaster County, Nebraska, September, 1 ♀, [Hebard Cln.I.

<sup>183</sup> Cameo, Roosevelt County, New Mexico, elev. 4124 feet, August 22, 1921, (Rehn and Hebard), 2 ♂, [Hebard Cln.I.

<sup>184</sup> The record of *Stagmomantis tolteca* from Venvideo and Los Mochis, Sinaloa, by Hebard (Trans. Amer. Entom. Soc., XLVIII, p. 185, (1923)) refers to a distinct new species which is being described elsewhere.

<sup>185</sup> Konowia, IV, pp. 160-161, (1925).

to *carolina*. From the state of Chiapas, however, I have before me one male recorded on a previous page. South of Mexico *carolina* is broadly distributed across all of Central America, material before me showing its occurrence in El Salvador,<sup>186</sup> a number of localities at varying elevations in Guatemala,<sup>187</sup> and in British Honduras,<sup>188</sup> while the literature and present material show it is well distributed in Honduras, Nicaragua,<sup>189</sup> Costa Rica and Panama. In South America, from the evidence of series before me, it goes south at least as far as San Antonio, Cauca, Colombia,<sup>190</sup> and eastward across Venezuela<sup>191</sup> as far as British Guiana<sup>192</sup> and Trinidad.<sup>193</sup> The literature carries its distribution south as far as Quito, Ecuador.<sup>194</sup> A single female before me, from the Academy collection, is said to be from Obidos, state of Pará, Brazil, which would represent its most extreme southern occurrence.

In Costa Rica *carolina* apparently occurs from sea-level on both coasts to at least as high as Corralillo, which is at an elevation of 1644 meters (5394 feet) on the south slope of the Volcán de Irazú. While in Costa Rica I have taken the species at but few localities, it is evident that there it occurs in a variety of habitats, ranging from the savanna of the Guanacaste district to the heavy Talamancan forest (Estrella Valley), as well as the varied cover of the more temperate central tableland (San José). This is quite in line with our knowledge of the ecological distribution of the species in North America, where within its range one finds it present in a broad variety of environments. Seasonally in Costa Rica it seems to be evenly distributed over the year, judging from the occurrence dates of adult material. In the more northern portion of the species' range it is largely immature from about April to July, and the available data from Costa Rica point to its greater abundance in the other months of the year, particularly at the higher elevations. The few adult specimens listed which were taken between April and July are from localities below eight hundred meters elevation.

<sup>186</sup> No exact locality, 1 ♀, [Hebard Cln.].

<sup>187</sup> Puerto Barrios, Guatemala, 1912, (W. P. Cockerell), 1 ♂. Material from Morales and Santa Emilia Pochuta has been recorded on a preceding page.

<sup>188</sup> Columbia, British Honduras, March, 1932, (J. J. White), 1 ♂, [Hebard Cln.].—Punta Gorda, Br. Honduras, February and March, 1931, (J. J. White), 9 ♂, [Hebard Cln.].—San Antonio, Br. Honduras, April, 1931, (J. J. White), 2 ♂, [Hebard Cln.].—Rio Grande, British Honduras has already been recorded on a preceding page.

<sup>189</sup> San Ramon, Rio Wanks, Nicaragua, June, 1905, (M. S. Palmer), 1 ♀.—Machuca, Nicaragua, (J. F. Bransford), 1 ♀.

<sup>190</sup> Hebard, Trans. Amer. Entom. Soc., XLV, p. 132, (1919).

<sup>191</sup> San Esteban, Venezuela, October-November, 1910, (M. A. Carriker, Jr.), 2 ♀.

<sup>192</sup> Bartica, British Guiana, December 31, 1912, (H. S. Parish), 1 ♂. Kartabo, British Guiana, (W. Beebe), October 25, 1920 (one), 2 ♂.

<sup>193</sup> Fyzabad, as recorded on a preceding page.

<sup>194</sup> Recorded by Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 114, (1894), as *Stagmomantis dimidiata*.



**Stagmomantis montana montana** Saussure and Zehntner. Plate 7, figures 22 and 23; plate 10, figure 3.

*Stagmomantis montana* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 141, 142 and 146, pl. IX, fig. 4, (1894), [♂, ♀; Acapulco, Tepetlapa and Chilpancingo, Guerrero, Mexico; Cordova (Cordoba), [Vera Cruz] Mexico; Volcan de Atitlan, 2500 to 3500 feet, Guatemala].

*Stagmomantis androgyna* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 142, 147, pl. VII, fig. 1, (1894), [♂; Belize, British Honduras].—Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 794. (1906), [♂; Surubres River at San Mateo, Costa Rica].

*Stagmatoptera typhon* Rehn, Canad. Entom., XXXVI, p. 107, (1904), [♀; San Marcos, Nicaragua].

*A[uromantis] cinctipes* Giglio-Tos, Bull. Soc. Entom. Ital., XLVIII, p. 56, (1917), [♂; Costa Rica].—Giglio-Tos, Das Tierreich, Lief. 50, pp. 385, 386, (1927), [Costa Rica].

*A[uromantis] montana* Giglio-Tos, Das Tierreich, Lief. 50, pp. 385, 386, (1927), [Costa Rica].

Oricuajo,<sup>195</sup> Rio Jesús Maria. Elevation, 225–250 feet. September 2, 1927. (Tristán and Rehn; at light at night.) One male.

San Mateo (Rio Surubres). Elevation, 250 meters. January, 1903. (P. Bionley.) One male, one female. [Hebard Cln.]

The present species is apparently not at all common and long series of it have never been secured. This factor, plus the marked resemblance of females to those of the genus *Stagmatoptera*, has chiefly been responsible for the synonymy given above, of which that of *androgyna* and *cinctipes* is here first correctly established.<sup>196</sup> Giglio-Tos in 1917<sup>197</sup> properly synonymized my *Stagmatoptera typhon* based on the female sex. Saussure and Zehntner's *androgyna*, it is evident from the series of thirteen males and two females of the species now before me, was based merely on a rather large male with an infusate tegminal stigma, which the evidence now before me shows is purely individual. Similarly Giglio-Tos' *cinctipes* was based on a single male in the intensively colored extreme of the brown phase, having the limbs banded and the wings markedly infumate. This, also, the present series establishes is of no specific value.<sup>198</sup>

<sup>195</sup> See footnote number 15 under *Musonia surinama*.

<sup>196</sup> Werner (Konowia, IV, p. 165, (1925)), however, considered *montana* to equal *limbata*, and *cinctipes* to be a synonym of *limbata*. Giglio-Tos' *cinctipes* is a synonym of *montana* but not of *limbata*. See footnote number 198.

<sup>197</sup> Bull. Soc. Entom. Ital., XLVIII, p. 55.

<sup>198</sup> Werner (Konowia, IV, pp. 164, 165, (1925)) has made the broad and unwarranted statement that *Stagmomantis limbata* (Hahn) has *S. montana* S. & Z. as one of its synonyms. Apparently he has failed to distinguish true *limbata*, of which a series of nineteen males and eleven females from Mexico, as well as scores of both sexes from the southwestern United States, are now before me, from the quite different *montana*. The measurements given by him for four females point very definitely in that direction. The females of *limbata* and *montana* can at once be separated by the more elongate and more sharply ovate cephalic section of the pronotum, the proportions of the facial shield, the broader and rather differently shaped tegmina of *montana* and the distinctly heavier cephalic limbs of the latter species. The males are less readily distinguished but there the whole body in *limbata* is much more slender, the cephalic limbs more delicate, the facial shield shallower and the marginal field of the tegmina less strongly

A study of the material now in hand shows that *montana* breaks up into two geographic races, a very small northern one, which also has diagnostic features other than size, and as far as known is of limited distribution in the state of Sinaloa, Mexico, and the typical form, which is of broader distribution, and intergrades with the more northern subspecies in portions of south-central Mexico. I here select, from the original localities cited by Saussure and Zehntner, the Volcan de Atitlan, Guatemala as the restricted type locality of *montana*, those in Guerrero and Vera Cruz given in the original description in all probability being represented by more or less intermediate material. The northern race of *montana* is being described elsewhere as *S. montana sinaloae*<sup>199</sup> and needs no detailed discussion here.

In size *montana montana* shows a considerable range in the male sex, both individual and geographic, although I have before me none quite as large as the type of *androgyna*. This, however, is strongly approached in certain listed below. Nothing definitely conclusive as to size variation can be drawn from the few females available. The following dimensions (in millimeters) illustrate the variation found.

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Length of cephalic femur
<i>S. m. sinaloae</i>					
♂, Los Mochis, Sinaloa, Mexico, type .....	51	15.5	3.27	34	11.1
Atypical <i>S. m. montana</i>					
♂, Jojutla, Morelos, Mexico <sup>200</sup> ..	51.5	17	3.36	37.5	12.2
♂, Monte Sumidero, Chiapas, Mexico <sup>201</sup> .....	53.5	16.2	3.69	39.5	11.6
Typical <i>S. m. montana</i>					
♂, Yucatan <sup>202</sup> .....	—	17.5	4.11	39.8	14
♂, Merida, Yucatan <sup>203</sup> .....	—	21	4.53	41.5	15
♂, Santa Emilia Pochuta, Guatemala <sup>204</sup> .....	59.5	18.6	3.86	45.5	13
♂, Santa Emilia Pochuta, Guatemala .....	59	19	4.03	47	13.8
♂, Surubres River, Costa Rica ..	61	20.5	4.45	45	14.7
♂, San Mateo, Costa Rica .....	62	20.6	4.7	47.5	15.2
♂, Oricuajo, Costa Rica .....	66.2	20	4.45	44.5	14
♀, San Marcos, Nicaragua (type of <i>Stagmatoptera typhon</i> ) ...	64	26.3	7.22	33.5	20.5
♀, San Mateo, Costa Rica .....	72	29.3	7.98	35.5	23.3

expanded proximad when compared with typical *montana montana*. In addition the male genitalia exhibit some features of relative though slight difference.

In distribution the two species largely occupy different areas, these overlapping only in portions of Mexico. *Limbata* does not extend south of Oaxaca, Mexico, while *montana* ranges to Costa Rica, yet does not reach northward to the southwestern United States, where *limbata* is present over a considerable area.

<sup>199</sup> Trans. Amer. Entom. Soc., LXI.

<sup>200</sup> May, 1929; (J. J. White); one male; [Hebard Cln.].

<sup>201</sup> May 30, 1926; (A. Dampf); one male; [Hebard Cln.].

<sup>202</sup> (Schott); one male. Abdomen shrivelled from wet preservative.

<sup>203</sup> (Gaumer); two males; [Hebard Cln.]. Abdomen lacking apex.

<sup>204</sup> Elevation, 1000 meters; February-March, 1931; (J. Bequaert); two males.

From the above evidence it is seen that while the male sex shows a fair amount of individual size variation at single localities, or those in one general type of country of similar elevation, there is a generally regular increase in size southward along the western coast of Central America. In Yucatan and adjacent British Honduras (Belize, vide *androgyna*), however, we find large or very large individuals, indicating that there, the only area immediately near the Atlantic coast line where the species is known to occur, for some reason conditions favor an optimum size development.

As to color, it is evident that in the male sex there is considerable variation within each color phase, both in the depth of the general pattern and the presence or absence of the white line costad of the humeral trunk of the tegmina. Four males before me are definitely referable to the brown phase, these being the three from Yucatan and the San Mateo male. In the latter the phase is less strongly developed than in the others and there is some green cephalad on the pronotum. None of the former show any trace of the cross barring of the limbs, on which *cinctipes* was based, but that from San Mateo (which may be the exact locality from which Giglio-Tos' male came, as he had other Costa Rican mantids from there) shows this very definitely developed. The infuscation of the stigma is also definitely seen to be individual, but it is apparently connected with the extent to which the discoidal vein and the narrow section of the discoidal field adjacent to it is infusate. In no case is the stigma infusate without correlated lining of this section, nor is this present without the stigma being infusate to some degree. The three Yucatan brown phase males all show definite infusate tessellation of the wings, although that from San Mateo is without these markings. It is probable the infusate alar pattern is present only in the strongly marked extreme of the brown phase. All the material of the small *S. montana sinaloae* has the stigma and the tegminal discoidal vein distinctly infusate, while the discoidal field is otherwise hyaline. That from Jojutla has virtually no stigmal or discoidal infuscation, while the Monte Sumidero male has the tegminal discoidal line very pronounced and the stigma infusate, but less than is the discoidal trunk section. All of these are in the green phase. The two Santa Emilia Pochuta females are also in the green phase, but lack infuscation of both the discoidal field and the stigma. In all three Yucatan males (brown phase), one of which from Mérida is most intensively colored, the tegminal discoidal vein and stigma are infusate. The Oricuajo male is in the green phase without stigmal or discoidal vein infuscation, while that from the Rio Surubres (recorded in 1906) has been somewhat discolored and stained by cyanide fumes. The San Mateo male has the infuscation of the stigma and tegminal discoidal vein marked.

The white line along the internal border of the marginal field of the male tegmina is distinctly marked in two specimens of *S. m. sinaloae*, and hardly at all evident in the third; not present at all in the Jujutla male, while that from Monte Sumidero has it strikingly contrasted. The two Yucatan males (Mérida) which are not discolored in that area, have the white line well indicated, while in the Guatemala and Costa Rican specimens of the same sex it is indicated, and then but weakly, in but one, which is from Santa Emilia Pochuta, Guatemala. The two females (San Marcos, Nicaragua and San Mateo, Costa Rica) seen are both in the extreme green phase, with non-infusate stigma and discoidal vein, and no trace of a white line in the marginal field. From the color observations here given it is evident the presence or absence of infuscation of the stigma, or of the white lining of the marginal field of the male tegmina has no specific or even racial value, but apparently are genetic features independent of the basic color phase, which is not genetic. The presence or absence, irrespective and independent of the color phase, of the features here discussed shows quite conclusively they are governed by different activating causes.

In the green phase the base color of the marginal field of the tegmina ranges from as light as deep colonial buff in the more pallid individuals, to as deep as bice green. The yellow tendency is present only in two males from Santa Emilia Pochuta, which are both very light in general color, which is chamois to honey yellow in one, washed with reed yellow in the other. In the brown phase this field may be either citron-green (San Mateo) or red brown, ranging from vinaceous-tawny to as deep as cinnamon-rufous, both of these represented by the two Mérida males. Thus the color of this field is probably genetic, and as independent of the body tone as is the stigmal infuscation, humeral pencilling and white streaking of the same field.

The distribution of the two subspecies of *Stagmomantis montana* is now known to extend along the western side of Mexico and Central America from as far north as northwestern Sinaloa (Los Mochis), Mexico (there *S. m. sinaloae*) southward over the Pacific slope portions of the states of Guerrero, Morelos and Chiapas, Mexico, western Guatemala, western Nicaragua and the lower levels of western Costa Rica, there not known to reach higher than about 750 feet above the sea (San Mateo), or south of Herradura Point. In southern Mexico its distribution extends eastward in suitable areas, reaching semi-arid Yucatan and there extending southward into northern British Honduras (Belize), while it has also been reported from Cordoba, Vera Cruz.

*Montana* is clearly partial to semi-arid or savannah districts, and has a type of distribution paralleled in many other species, which otherwise

restricted to the western side of Mexico and Central America reach eastward in suitable areas and are common in the semi-arid Yucatan peninsula and adjacent areas of British Honduras.

Little definite information is available regarding the habits of the species, other than that the males are attracted to light at night. Seasonally it is known to occur from December to May, and again in early September. Of these months, January and February and early September are from Costa Rican material. Whether the species occurs virtually throughout the year, or is two-brooded in the last mentioned country, remains to be determined. It clearly occurs adult in both the wet and dry seasons.

**Stagmomantis theophila** Rehn. Plate 7, figures 24 and 25; plate 10, figure 4.

*Stagmomantis theophila* Rehn, Proc. U. S. Nat. Mus., XXVII, p. 563, (1904), [♂; Turrialba, Costa Rica].—Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 340, (1923), [Costa Rica].

*Stagmatoptera insatiabilis* Rehn, Proc. U. S. Nat. Mus., XXVII, p. 572, (1904), [♀; Turrialba, Costa Rica].—Rehn, Genera Insectorum, fasc. 119, p. 13, (1911), [Costa Rica].—Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Torino, XXIX, no. 684, pp. 26, 36, (1914), [Turrialba].

*Stagmomantis denticulata* Chopard, Ann. Soc. Entom. France, LXXXV, p. 162, (1916), [♂; Chimbo, Ecuador].

*Stauromantis theophila* Giglio-Tos, Bull. Soc. Entom. Ital., XLVIII, p. 55, (1917), [Costa Rica].—Giglio-Tos, Das Tierreich, Lief. 50, p. 385, (1927), [♂, ♀; Costa Rica].

*St[auromantis] festae* Giglio-Tos, Bull. Soc. Entom. Ital., XLVIII, p. 55, (1917), [♂, ♀; Guayaquil (type locality) and Vines, Ecuador].

*Stagmomantis denticollis* Werner, Konowia, IV, p. 163, (1925), [♂; Colombia (type locality); Huasco and Muzo, Colombia].

Hamburg Farm, lower Rio Reventazón. April 30. (C. W. Dodge.) One male. [M. C. Z.]

Philadelphia South Farm, Banana River district. November 7, 1909. (P. P. Calvert.) One male.

Giglio-Tos first referred *Stagmatoptera insatiabilis* to this species in 1917,<sup>205</sup> the name having been based on the very different appearing female. The synonymy of Chopard's *denticulata* and Giglio-Tos' *festae* was established by Hebard in 1923,<sup>206</sup> and that of Werner's *denticollis* by him in 1933.<sup>207</sup>

The definitely subcarinate condition of the caudal tibiae of the female sex of this species was responsible for the description of that sex as a *Stagmatoptera*, and the definite relationship of the two genera is clearly evident through this species, *montana* and *limbata*. As I have remarked on a preceding page under discussion of the genus *Stagmomantis*, tibial carination is of no value as the chief diagnostic feature of the subfamily Vatinae, and *Stagmatoptera*, which has been placed in that group by pre-

<sup>205</sup> Bullett. Soc. Entom. Ital., XLVIII, p. 55, (1916).

<sup>206</sup> Trans. Amer. Entom. Soc., XLVIII, p. 340, (1923).

<sup>207</sup> Trans. Amer. Entom. Soc., LIX, p. 29, (1933).

vious workers, must be removed to the Mantinae and placed in the immediate vicinity of *Stagmomantis*.

The present species is distinctive among all those referable to *Stagmomantis* in the marked character of the sublamellate dentation on the flexor margin of the cephalic coxae, and the emphasis of the dentations (♀) or denticulations (♂) on the lateral margins of the collar and cephalic half of the shaft of the pronotum.

The available series of male specimens throws some interesting light on the amount of variation found in a single species of the genus, in the extent to which the marginal field of the tegmina in that sex may be opaque or hyaline. *Theophila* is considered by Giglio-Tos to have this area hyaline with a band of opaque white along the proximal half of the mediastine vein. The present series shows that the width of this opaque white band varies from a mere fine line, to an opposite extreme in which it covers slightly more than half the width of the field. The latter condition is seen in the specimens from Nicaragua and Costa Rica, while those from Ecuador have the band averaging narrower. The broadest white band is found in a male from the Great Falls of the Pis Pis River, Nicaragua, and any increase in extent of the same over that found in it would produce a marginal field almost entirely opaque white, and following the handling of this feature by Giglio-Tos the student would be completely misled as to its real relationship.

The number of large teeth present on the flexor margin of the cephalic coxae varies from three (Chopard for *denticulata*) to eight (Werner for *denticollis*). The series of twelve males and two adult females now before me shows from four to seven in the male and five in the females. The Costa Rican males known exhibit a range of from five to seven, the females always five. An El Salado, Ecuador male<sup>208</sup> shows four or five, the smallest number present in any specimen personally examined. While the Ecuador males generally show a smaller number of coxal teeth (four to six) than Nicaraguan, Costa Rican or Panamanian males, this is not an invariable rule. The male type of *theophila*, from Costa Rica, possesses but five to six teeth, or the same number as in two of four of the Ecuadorian males seen, i. e. those from Lita and Paramba. The adult female from Bucay, Ecuador recorded by Hebard,<sup>209</sup> and an immature one from Huigra in the same country<sup>210</sup> both agree with the type and paratype of *insatiabilis* in having but five teeth.

Hebard<sup>211</sup> has given the size range in pronotal and tegminal proportions as found in eight Panamanian males. The type individual has slightly

<sup>208</sup> (F. Campos).

<sup>209</sup> Proc. Acad. Nat. Sci. Phila., LXXVI, p. 131, (1924).

<sup>210</sup> Elevation, 1300 meters; (F. Campos).

<sup>211</sup> Trans. Amer. Entom. Soc., XLVIII, p. 341, (1923).

longer tegmina (i. e. 39.5 mm.) than any of the Panamanian ones, and the dimensions of the Costa Rican specimens here recorded are within the range given in the measurements already published. To the southward in Ecuador the species averages smaller than in Costa Rica, as already stated by Hebard,<sup>212</sup> and given added emphasis by the additional male now before me from El Salado, Ecuador, which shows the following dimensions: length of body, 47.5 mm.; length of pronotum, 15.4; greatest width of pronotum, 3; length of tegmen, 32.8. This is but slightly larger than the measurements of the type male of the synonymic *festae*, from Guayaquil, Ecuador.

From previous records and material now available the range of *theophila* is known to extend from eastern Nicaragua (Great Falls of the Pis Pis River<sup>213</sup>) south across eastern Costa Rica, lowland Panama, the Magdalena River region of Colombia (Muzo)<sup>214</sup> and western Ecuador (Lita, Paramba, Vinces, Guayaquil, Duran, Chimbo and El Salado). In Costa Rica it is limited to the eastern rain forest, not being known from higher than Turrialba, which is at an elevation of slightly over 2000 feet. The seasonal range as adults is from at least late April (Hamburg Farm) to early November (Philadelphia South).

Nothing has been reported or noted on the habits of *theophila*. Personally I have never taken the species, although it doubtless occurs at a number of localities at which I have worked.

#### STAGMATOPTERA Burmeister

*Stagmatoptera* Burmeister, Handb. der Entom., II, Abth. II, pt. 1, p. 537, (1838).

Genotype (by selection of Rehn, 1904).<sup>215</sup> — *Mantis* (*Stagmatoptera*) *rogatoria* Burmeister = *S. binotata* Scudder, 1869.<sup>216</sup>

This genus includes approximately a dozen species, limited in distribution to tropical America, ranging from at least as far north as eastern

<sup>212</sup> Idem, p. 340.

<sup>213</sup> Ten miles northwest of Eden Mine, Nicaragua; May 26, 1922; (Wharton Huber); one male.

<sup>214</sup> I am unable to locate "Huasco", given as a Colombian locality by Werner, but I question the reference of this place to Colombia on philological grounds, as well as its unfamiliarity to me and one of my colleagues, Mr. M. A. Carriker, Jr., who has spent many years in zoological field work in that country. The name is evidently Inca, not Muisca.

<sup>215</sup> Proc. U. S. Nat. Mus., XXVII, p. 571, (1904).

<sup>216</sup> This is not *Mantis rogatoria* Stoll, 1813 (Natuurl. Afbeeld. Beschr., Spoken, etc., p. 73, pl. XXV, fig. 95) which equals *precaria* of Linnaeus, but a distinct species independently named by Burmeister, without reference to Stoll's name. In consequence Burmeister's name is that of the genotypic species, being erected without reference to the earlier *rogatoria*. The oldest specific name applied to the species described by Burmeister therefore holds as that of the genotype. Giglio-Tos' use of *precaria* (Linnaeus) as the genotype (Das Tierreich, Lief. 50, p. 593, (1927)), apparently based on Kirby (Synon. Catal. Orth., I, p. 299, (1905)), is invalid in the face of the prior fixation above cited. Rehn's 1911 use of *predicatoria* Saussure as the genotype (Gen. Insect. Vatinæ (fasc. 119), p. 12) was correct, as *predicatoria* was based on the same species as *binotata*, but the latter has priority.

Costa Rica,<sup>217</sup> south to northern Argentina, and from Peru to eastern Brazil. Certain African<sup>218</sup> and Malagasy species have been referred to this genus, but are now removed to genera (i. e. *Bisanthe* and *Tisma*) belonging to other subfamilies.

I have discussed above under *Stagmomantis* the conclusions reached on the subfamily position of *Stagmatoptera* and the close relationship of the two genera. Placed for many years in the Vatinæ, *Stagmatoptera* must be removed from that assemblage and given a position in the Mantinæ in very close proximity to *Stagmomantis*. How many other Neotropical genera with which it had been associated in the Vatinæ may require similar transfer, must await further critical studies.

***Stagmatoptera septentrionalis* Saussure and Zehntner.**

*Stagmatoptera septentrionalis* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 186, pl. VIII, fig. 2, (1894), [♀; Bugaba, Panama].

[*Stagmatoptera septentrionalis*] var. *minor* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 187, (1894), [♀; Colombia; Venezuela].

[*Stagmatoptera incerta* Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Univ. Torino, XXIX, no. 684, p. 27, (1914), [♂; Costa Rica and unknown locality].—Giglio-Tos, Das Tierreich, Lief. 50, pp. 594, 595, [♀; Costa Rica].

Carrillo. (C. F. Underwood.) One female. [Hebard Cln.]

In 1921<sup>219</sup> Hebard synonymized variety *minor* as an individual variation of the species. With this I fully agree after an examination of the series of thirty-two adult specimens (23 ♂, 9 ♀) of the species in the Philadelphia series, although there is some geographic correlation of size fluctuation. Giglio-Tos' *incerta* is apparently nothing but the condition found in many males of the species, the discoidal field of the tegmina having the portion bordering the humeral trunk opaque to a variable extent, this opacity often showing a herring-bone character by following along and involving the oblique cross-nervures between the sectors. This is specifically mentioned by Giglio-Tos, who says (1927) of *incerta*, "l'aire discoidale des élytres opaque le long des veines radiales et puis avec des bandes jaunes sur les petites veines transverses". Giglio-Tos erred in comparing *incerta* with *supplicaria*, to which the resemblance of males of *septentrionalis* is pronounced, but that sex of the two species can readily be separated by the appreciably broader tegminal marginal field of *septen-*

<sup>217</sup> Giglio-Tos (Das Tierreich, Lief. 50, p. 598, (1927)) has given Mexico as one of the localities for *S. biocellata*, which otherwise is not known from north of Venezuela. I question whether the material so labelled really came from Mexico, and until further confirmation is available prefer to give the definite northern limit of the genus as that of the most northern unquestioned record (i.e. Carrillo, Costa Rica).

<sup>218</sup> Giglio-Tos (Boll. Mus. Zool. Anat. Comp. Torino, XXIX, no. 684, p. 31, (1914)) has also described a variety *africana* of *S. femoralis*, which he said was thought to be from Tanganyika Territory, but that doubt existed as to the correctness of the locality. In my mind there is no doubt but that this material came originally from tropical America.

<sup>219</sup> Trans. Amer. Entom. Soc., XLVII, p. 160.



*trionalis*, as well as certain apparently constant, although not pronounced, color features. My opinion as to the constancy of these features is drawn from the examination of the above-mentioned twenty-three males of *septentrionalis* and ten of the same sex of *supplicaria*.<sup>220</sup> The females of *septentrionalis* and *supplicaria* also can be separated by the distinctly broader marginal field of the former, as well as in that species heavier cephalic limbs and much smaller tegminal ocellation.

Included in the series of *septentrionalis* before me are six males from Panama localities,<sup>221</sup> six from Boca Murindó, Chocó, Colombia,<sup>222</sup> and seven from Caparo, Trinidad.<sup>223</sup> In the first mentioned the *incerta* type of tegmina alone is indicated, in the Boca Murindó lot this is less decided, but the discoidal field is always somewhat encroached upon by opacity, while in Caparo specimens we find this overlapping less evident, to the point of virtual absence in the recessive extreme. As the type locality of *septentrionalis* is in Chiriqui Province, Panama, and all the males seen from that country are of the *incerta* extreme, the synonymy of these names is obvious.

No importance can be given to the degree of emphasis of the fuscous maculation on the internal face of the cephalic femora, as the present series shows beyond any possible argument that its emphasis and extent is purely an individual feature. This is also true of many other species of the family similarly maculate with black.

The size range in the species is pronounced, although usually there is reasonable stability at any one locality. The smallest specimens seen are males from Boca Murindó, Chocó, and Andagoya, Antioquia, Colombia,<sup>224</sup> while the largest males are from Gatun, Panama.<sup>225</sup> The smallest female is from Santa Marta, Colombia,<sup>226</sup> while the Carrillo, Costa Rica female is as large as any other seen. Representative individuals show the following measurements (in millimeters):

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<sup>220</sup> Nouveau Chantier, French Guiana; January, May, November, December; 3♂, 1♀; [Hebard Cln.]. St. Jean du Maroni, French Guiana; January, December; 1♂, 1♀; [Hebard Cln.]: (Le Moulit); 1♂; [Hebard Cln.]. Tumatumari, British Guiana; April 1912; (Lutz); 4♂; [A.N.S.P. and Hebard Cln.]. Porto Velho, Rio Madeira, Brazil; (Mann and Baker); 1♂. Chanchamayo, Peru; 1♀.

<sup>221</sup> See Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 334, (1923).

<sup>222</sup> See Hebard, Trans. Amer. Entom. Soc., XLVII, p. 160, (1921).

<sup>223</sup> June; (S. M. Klages).

<sup>224</sup> See Hebard, Trans. Amer. Entom. Soc., XLVII, p. 161, (1921).

<sup>225</sup> Reported but not measured by Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 344, (1923).

<sup>226</sup> Reported by Hebard, Trans. Amer. Entom. Soc., XLV, p. 139, (1919).

	Length of body	Length of pronotum	Greatest width of pronotum across supra-coxal expansions	Length of tegmen	Greatest width of marginal field of tegmen	Length of cephalic femur
♂, Gatun, Panama .....	82	28.4	5.7	56	3.9	16.8
♂, Gatun, Panama .....	72.6	26.3	5.4	53.8	3.8	16.2
♂, Boco Murindó, Colombia <sup>227</sup> .....	66.2	23.2	4.8	48.9	3.1	14.6
♂, Andagoya, Colombia <sup>227</sup> .....	65	23.8	4.7	48.2	3.3	14.4
♂, Muzo, Boyacá, Colombia <sup>227</sup> .....	65	24.3	5	50.8	3.2	14.9
♂, Muzo, Boyacá, Colombia <sup>227</sup> .....	75.4	27.4	5.2	58.5	3.5	16.9
♂, Caparo, Trinidad ....	69.5	24.8	5	49.5	3.2	15
♂, Caparo, Trinidad ....	74	26.2	5.3	51.5	3.7	16.7
♀, Carrillo, Costa Rica ..	89	38	8.3	52	8.6	24.5
♀, Barro Colorado, Canal Zone <sup>228</sup> .....	86	36	8.1	49.5	8.2	23
♀, Santa Marta, Colombia <sup>229</sup> .....	77	32	7.5	41.5	7.1	20
♀, Fusugasugá Cundin- amarca, Colombia <sup>230</sup> ..	—	37.8	7.9	53	8.6	24.7
♀, Cauca, Colombia <sup>231</sup> ..	85.5	35	8.6	53	9	23.8
♀, Villavicencio, Meta, Colombia <sup>232</sup> .....	90.5	37.4	8.2	51	8.9	23
♀, San Esteban, Cara- bobo, Venezuela <sup>233</sup> ..	82	31.3	7.5	43.5	7.6	20.6
♀, St. Joseph, Trinidad <sup>234</sup>	84	35.5	8.3	50	8.9	23

The size range shown by the Muzo males, and to a lesser degree by the Caparo extremes, is very considerable, and must temper any broad conclusion as to a geographic correlation of size variation. Against this it should be noted that the larger Muzo individual is far larger than any other male of the nine seen from Colombia, the six from Boco Murindó being very uniform, equal to or but slightly larger than that from Andagoya measured above. It is fair to conclude, however, that under the conditions of semi-aridity found along the north coast of South America (i. e. Santa Marta and San Esteban) the species is smaller than it is under rain-forest conditions in eastern Costa Rica or in Panama. Knowledge of exact conditions under which the Muzo individuals were taken might explain the decided difference in size of the two males.

<sup>227</sup> Reported by Hebard, Trans. Amer. Entom. Soc., XLVII, p. 160, (1921).

<sup>228</sup> Reported by Hebard, Trans. Amer. Entom. Soc., LIX, p. 122, (1933).

<sup>229</sup> Reported by Hebard, Trans. Amer. Entom. Soc., XLV, p. 139, (1919).

<sup>230</sup> Reported by Hebard, Trans. Amer. Entom. Soc., XLVII, p. 160, (1921).

<sup>231</sup> Reported by Hebard, Trans. Amer. Entom. Soc., XLV, p. 139, (1919).

<sup>232</sup> Reported by Hebard, Trans. Amer. Entom. Soc., XLVII, p. 160, (1921).

<sup>233</sup> October-November, 1910; (M. A. Carriker, Jr.); one female.

<sup>234</sup> October 14 and 29, 1915; (R. A. Wood); one male, one female; [Hebard Cln.].

In distribution *S. septentrionalis* is now known to range from eastern Costa Rica (Carrillo) southward to northern (Chocó, Antioquia, and Santa Marta districts) and eastern Colombia (Muzo, Boyacá and Villavicencio, Meta), eastward across northern Venezuela to the delta region of the Orinoco,<sup>235</sup> and also in Trinidad. I do not know of its occurrence in the Amazonian basin or in the Guianas, where it appears to be replaced by other species. How far it extends into the interior of Venezuela is also unknown. In Costa Rica it is known only from the rain-forest section of the Tropical Zone. We know virtually nothing regarding the habits of the species, or its periodicity in Costa Rica. Elsewhere it is known to occur adult from January (Pedernales) to December (Pinogana, Panama and Santa Marta, Colombia), all months being represented except February and March.

#### TAUROMANTIS Giglio-Tos

*Tauromantis* Giglio-Tos, Bull. Soc. Entom. Ital., XLVIII, p. 57, (1917).

Genotype (by original designation), *Phasmomantis championi* Saussure and Zehntner.

This genus contains but the single species discussed below.

***Tauromantis championi*** (Saussure and Zehntner).

*Phasmomantis championi* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 149, pl. VII, fig. 6, (1894), [♀; Volcán de Chiriqui, Panama].—Giglio-Tos, Bull. Soc. Entom. Ital., XLVIII, p. 57, (1917), [♂; Costa Rica].

*Stagmomantis longicollis* Werner, Konowia, IV, p. 164, (1925), [♂; Chiriqui, Panama].

*T[auromantis] championi* Giglio-Tos, Das Tierreich, Lief. 50, p. 391, (1927), [♂, ♀; Panama; Costa Rica].—Hebard, Trans. Amer. Entom. Soc., LIX, p. 121, (1933), [♀; Juan Viñas, Costa Rica; "Costa Rica"].

Juan Viñas. One female. [Hebard Chn.]

"Costa Rica." One female. [Hebard Chn.]

The synonymy of *Stagmomantis longicollis*, based on the male sex, has already been established by Hebard,<sup>236</sup> and after a careful examination of the literature I fully concur in his action.

The females before me, which have already been recorded by Hebard, show that Saussure and Zehntner's original figure fails to emphasize sufficiently the marked and subtriangular character of the expansion of the supra-coxal region of the pronotum in that sex. In size one of the present individuals is very faintly smaller, the other slightly larger than the measurements originally given. Both are mottled ochraceous and wood brown in color, with the details of the pattern as described by Saussure and Zehntner and Giglio-Tos in 1927.

<sup>235</sup> Pedernales, Delta Amacuro Territory, Venezuela; January 25, 1911; (Stewardson Brown); one female.

<sup>236</sup> Trans. Amer. Entom. Soc., LIX, p. 121, (1933).

Our knowledge of the distribution of the species, and incidentally the genus, is drawn entirely from the evidence of the type and the records cited above. From these it is seen that the species is definitely known only from the Volcán de Chiriqui, Chiriqui Province, Panama, and Juan Viñas, Costa Rica. There is no information as to its distribution outside of these countries,<sup>237</sup> or as to its altitudinal distribution other than that of Juan Viñas (3000 feet). Similarly we have no information bearing on the seasonal occurrence of *championi*.

#### ACONTIOTHESPINAE<sup>238</sup>

This tropical American group of small mantids of distinctive form and often striking coloration is exceptionally interesting, if for no other reason than the unusual ant-like appearance of the immature stages. The species are in part at least difficult to distinguish, the correlation of the sexes is by no means easy, and coloration range within most of the species but poorly understood. In consequence the literature is much involved, often contradictory, and the last study of the group, that by Giglio-Tos,<sup>239</sup> has done little to clear up the difficulties, largely on account of his failure to appreciate intra-specific variation, and also the disregard of discussions on relationship and affinity which had been presented in print<sup>240</sup> as much as eight years before the appearance of the Giglio-Tos monograph. In consequence the latter author's study is valueless for determining the Central American species of the subfamily, while for the South American species it gives us a number of names but little regarding their true status, or the natural relationship of the species.

#### ACONTISTELLA Beier

*Acontista* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 130, (1894). [Part.]  
*Acontistella* Beier, Zoolog. Anzeiger, LXXXI, p. 246, fig. 1, (1929).

Genotype (by monotypy).—*A. amazonica* Beier.<sup>241</sup>

<sup>237</sup> Beier (Mitt. Zool. Statsinst. u. Zool. Mus. Hamburg, XLV, p. 18, (1931)) infers the species occurs in Colombia, by crediting the record of a female specimen to "Chiriqui, Columbien". Hebard (Trans. Amer. Entom. Soc., LIX, p. 121, (1933)) recently pointed out Beier's error, and emphasized the fact that Chiriqui has been a political unit of Panama and not of Colombia for many years.

<sup>238</sup> This subfamily is called the Acontistinae by Giglio-Tos (Bull. Soc. Entom. Ital., XLVI, p. 75, (1915)), but as Hebard has pointed out (Proc. Acad. Nat. Sci. Phila., LXXXVI, p. 132, (1924)) the group should be known as the Acontiothespinae. This is due to the proper generic name of the typical genus being *Acontiothespis*, as discussed on a subsequent page.

<sup>239</sup> Das Tierreich, Lief. 50, pp. 500-507, (1927).

<sup>240</sup> Hebard, Trans. Amer. Entom. Soc., XLV, pp. 130-131, (1919).

<sup>241</sup> While I have not seen the genotypic species (*A. amazonica* Beier, Zoolog. Anzeiger, LXXXI, p. 247, fig. 1, (1929), [♂; Alto Amazonas]), I have before me the male type and the female allotype of *Acontiothespis ecuadorica* Hebard (Proc. Acad. Nat. Sci. Phila., LXXXVI, p. 132, pl. V, figs. 11 and 12, (1924), [♂, ♀; Río Pescado, Cuenca Canton, Azuay, Ecuador]) which is extremely close to *amazonica*. Hebard's

I am by no means convinced of the desirability of recognizing *Acontistella* as distinct from *Acontiothespis*. With a majority of the species which have been referred to the two entities now before me, the degree of convergence is so marked that it is questionable whether the two categories can be maintained as distinct genera or even subgenera. The more slender pronotum of *Acontistella* alone can hardly be considered as of generic value, as among the various species of undoubted *Acontiothespis* we have a very appreciable amount of fluctuation in this respect. The sculpture of the pronotum, however, is somewhat different in the two, while the distinctly infumate tegmina and wings of the male, as against the largely hyaline ones of the same sex of *Acontiothespis*, would seem to indicate a natural group, although there is no correlation in the female sex. Tentatively I am using Beier's generic name without expressing any definite opinion as to its generic validity. This can be given only after the study of a rather extensive series of the subfamily from South America now in hand. Therefore the present use of *Acontistella* is without personal commitment as to its generic validity.

The distribution of *Acontistella* is at present known to extend from eastern Costa Rica (*fraterna*) to the lower eastern slopes of the Ecuadorian Andes (*ecuadorica*) and thence eastward over at least a portion of Upper Amazonia (*amazonica*). Unstudied collections, however, appear to indicate a broader distribution in northern South America.

***Acontistella fraterna*** (Saussure and Zehntner).<sup>242</sup>

*Acontista fraterna* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 136. (1894), [♀; Caché (=Cachi), Costa Rica].—Rehn, Proc. U. S. Nat. Mus., XXVII, p. 562. (1904). [♀; Tucurrique, Costa Rica].—Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 794. (1906), [♀; Carrillo, Costa Rica].—Hebard, Proc. Acad. Nat. Sci. Phila., LXXVI, p. 132. (1924). [♂; Carrillo, Costa Rica].

*Acontistella violacea* Beier, Mitteil. Zool. Staatsinst. u. Zool. Mus. Hamburg, XLV, p. 18. (1931), [♂; Hamburg Farm, Rio Reventazón, Costa Rica].

Carrillo. August to September, 1903. (Underwood.) Two males. [Hebard Cln.]

Guápiles. Elevation, 984 feet. September 12, 1927. (Rehn; swept from low bushes along railroad track.) One immature female.

In addition to these specimens I have also before me the female from Tucurrique reported by me in 1904.

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*Acontiothespis iriodes* (Trans. Amer. Entom. Soc., XLV, p. 130, pl. XVIII, fig. 5, (1919), [♂; Santa Marta, Colombia]) is, however, a true *Acontiothespis*, and not an *Acontistella*, as suggested by Beier, having the type of pronotum and alar features found in the former genus. The type of *iriodes* and an extensive series of virtual topotypes are now before me.

<sup>242</sup> Giglio-Tos in his revision of the Mantidae (Das Tierreich, Lief. 50, (1927)) either had but little material of this subfamily or gave the literature but casual attention. The present very distinct species was placed by him (p. 503) as a synonym of the very different *cordillerae*, along with the equally reprehensible synonymy of the quite distinct *gracilis* Chopard under the same species.

The synonymy of Beier's *violacea* is at once evident upon the examination of both sexes of this beautiful and distinctive species, which, as usual in the group, shows very decided sexual differences. The Tucurrique female fully agrees with the original description of that sex, while Beier's description of *violacea* supplies the essential male features. The brilliant bluish violet iridescence of the solidly infumate wing of the male is very marked, as is also the lacquer-like sheen on the infumate discoidal and anal areas of the tegmina and the dorsal surface of the abdomen of the same sex. In one male the tegmina show an indication of an incomplete transverse subhyaline bar, which, however, is not definitely indicated in the other individual of the same sex. In neither male are the cephalic limbs transversely banded with brown except on the tibiae, but the median and caudal limbs are appreciably brown annulate, as described by Beier.

The color pattern of the wing of the female is well described by Sausure and Zehntner, except that the hyaline area distad in the anterior field is carried toward the body about the periphery of the posterior field, narrowing regularly, to a point about halfway to the body. The very narrow buff-brown area, which is almost entirely confined to the anterior and enters the posterior field of the wings of the female only very briefly proximad, combined with the far more slender pronotum, will at once distinguish females of *Acontistella fraterna* from the same sex of *Acontiothespis cordilerae vitrea*, which also occurs in Costa Rica.

Apparently *fraterna* in Costa Rica is a species of the Atlantic section of the Tropical Zone, not known to reach higher levels than the vicinity of Cachí (approximately 1000 meters above the sea). The present known records show its presence at three localities in the Reventazón Valley and two localities in the upper level of the adjacent Santa Clara Plain to the north of the Cordillera Central (i. e. Guápiles and Carrillo). The area of distribution is thus entirely within the rain-forest belt.

No notes on the habits of the species are available other than that the immature female from Guápiles was swept from low bushes under guayabo and melastomaceous trees along the railroad track. Our entire knowledge of the seasonal occurrence of *fraterna* is that it has been taken adult in late March (Beier, paratype of *violacea*), August to September (as above) and in late September (type of *violacea*). The capture on September 12 of a specimen in at least two instars preceding maturity would indicate adults present well into October. If the species is single-brooded this information would also indicate maturity extends from at least as early as September to as late as the end of March, or the latter half of the wet and the first part of the dry seasons.

**ACONTIOTHESPIS** Rehn

*Acontistes* Burmeister, Handbuch der Entom., II, Abth. II, pt. I, p. 542, (1838).

*Acontista* Saussure, Mitt. Schw. Entom. Gesell., III, pp. 55, 62, (1869). (Emendation only).

*Acontiothespis* Rehn, Trans. Amer. Entom. Soc., XLII, p. 258, (1916).

Genotype.—*Mantis tricolor* Burmeister (= *Mantis concinna* Perty).<sup>243</sup>

Burmeister's generic name falls on account of the prior (1835) use of the same in birds by Sundevall. Saussure merely altered the termination, along with that of a number of other generic names of mantids to make them agree in feminine gender. His form of Burmeister's name, and to which author he originally credited the altered term, is merely an emendation, and not a substitute name, not being properly proposed or used as a replacement of *Acontistes*, while the unavailability of the latter was not even mentioned at the time the emended form was first used. The subsequent use of the emended form *Acontista* by Saussure and Zehntner,<sup>244</sup> who then pointed out the preoccupation of Burmeister's name, in no way alters the character of *Acontista*. This opinion is shared by numerous colleagues, taxonomic specialists in various branches of zoology, by whom the question has been examined at my request.

The genus *Acontiothespis* includes a number of species limited to Tropical America. Giglio-Tos in his revision of the family<sup>245</sup> lists twenty-four species, but one or more of these belong to the more recently erected *Acontistella* (vide supra), while the treatment of the others is often unsatisfactory, the association of previously erected names in a number of cases is definitely erroneous,<sup>246</sup> the sex correlations are poorly worked out, and closely related forms, or in fact mere geographic races of the same species, are separated in his treatment by from one to sixteen widely distinct entities.<sup>247</sup> The distributions given for certain forms are also misleading and unwarranted, due largely to the erroneous associations of specific names. While Giglio-Tos' section on the genus will enable the student to use a

<sup>243</sup> By designation of Rehn (Proc. U.S. Nat. Mus., XXVII, p. 561, (February, 1904)).

<sup>244</sup> Biol. Cent.-Amer., Orth., I, p. 130, (1894).

<sup>245</sup> Das Tierreich, Lief. 50, pp. 500-507, (1927).

<sup>246</sup> Chopard's *gracilis* (Ann. Soc. Entom. France, LXXX, p. 317, figs., (1912), [♂, ♀; St. Laurent du Maroni and Nouveau Chantier, French Guiana]) is said to be based on the sexes of two species, and the female is placed as a synonym of *cordillerae* Saussure, while the male is renamed *chopardi*. I have before me, from the Hebard Collection, a female paratype of the species from Nouveau Chantier, received from Dr. Chopard, which shows conclusively that the female sex of *gracilis* has nothing to do with *cordillerae*, but is a species with an elongate pronotum, much resembling the forms of *Acontistella*, as is well shown in Chopard's original figure of the female. From the figures the sexes appear to be conspecific, but at any rate the female sex, which was described first and at greater length, is in no way related to *cordillerae*.

<sup>247</sup> The names *mexicana* and *cordillerae* are separated by another species although they are synonymous, while *vitrea* is sixteen species removed from *cordillerae*, although but a geographic race of the latter.

name for the material he is examining, there can be little certainty it is the proper one without a detailed study of numerous original descriptions.

**Acontiothespis cordillerae**<sup>248</sup> *vitrea* (Saussure and Zehntner).

*Acontista vitrea* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 133, 138, pl. VI, fig. 9, (1894), [♂; Atoyac, Vera Cruz, Mexico; <sup>249</sup> Costa Rica; <sup>250</sup> Volcán de Chiriqui, 2000-3000 feet, Panamá].—Rehn, Proc. U. S. Nat. Mus., XXVII, p. 562, (1904), [♂; Piedras Negras, Costa Rica].—Giglio-Tos, Das Tierreich, Lief. 50, p. 507, (1927), [♂; Costa Rica].

*Acontista mexicana* Rehn, Proc. U. S. Nat. Mus., XXVII, p. 562, (1904), [♀; Piedras Negras and Turrialba, Costa Rica].

*Acontista cordillerae* Giglio-Tos, Das Tierreich, Lief. 50, p. 503, (1927), [♂, ♀; in part, Costa Rica only].

*Acontista cordillerae vitrea* Hebard, Proc. Acad. Nat. Sci. Phila., LXXVI, p. 132, (1924), [♂, ♀; Costa Rica].

Las Loras, near Puntarenas. (Frederick Knab.) One female. [U.S. N.M.]

Oricuajo, Rio Jesús Maria.<sup>251</sup> August 31 (♀) and September 2 (♂), 1927. (Tristán and Rehn; male attracted to light at night, female beaten from tree foliage.) One male, one female.

Pozo Azul de Pirris. (M. A. Carriker, Jr.) One male. [Hebard Collection.]

<sup>248</sup> The more northern and typical subspecies has the following synonymy:

*Alcontista cordillerae* Saussure, Mitt. Schw. Entom. Gesell., III, p. 62, (1869), [♂; Mexico].

*Acontista mexicana* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 132, 135, (1894), [♀; Cordova and Atoyac, Vera Cruz, Mexico; Guerrero, Mexico; Chontales Nicaragua; Bugaba, 800-1500 feet, and Volcán de Chiriqui, 2000-3000 feet, Panamá].

[*Acontista mexicana*] var. *inquinata* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 133, 136, pl. VI, fig. 10, (1894), [♂; Cordova, Vera Cruz, Mexico; Acapulco and Acaguizotla, Guerrero, Mexico].

[*Acontista mexicana*] var. *quadrinaculata* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, pp. 133, 136, pl. VI, fig. 8, (1894), [♂; Lanquin, Guatemala]. (Not *Mantis quadrinaculata* Serville, 1839, now referred to this genus.)

*Alcontista championi* Kirby, Synon. Catal. Orth., I, p. 233, (1904). (Renaming *quadrinaculata* Saussure and Zehntner on account of preoccupation of latter specific name.)

As long ago as 1919 Hebard (Trans. Amer. Entom. Soc., XLV, p. 130, footnote) suggested that *mexicana* and *mexicana* var. *quadrinaculata* were mere color variations of *cordillerae*, and the same author in 1932 (Trans. Amer. Entom. Soc., LVIII, p. 213) reiterated his belief that *mexicana* was synonymous with *cordillerae*. It is definitely certain the two names were based on opposite sexes of the same species, the typical form of which runs through a considerable degree of individual variation in color pattern and intensity, paralleling what is known to occur in other species of the genus.

The reference of Panama material to *mexicana* and not to *vitrea*, was due to the fact that Saussure and Zehntner failed to recognize these females as distinct from Mexican individuals of the same sex. My comments above under *vitrea* emphasize the slight differentiation of females of the two races. The varieties *inquinata* and *quadrinaculata* (= *championi*) represent merely degrees of tegmental and wing infuscation in males of true *cordillerae*, which areas in that sex of *A. c. vitrea* are hyaline except along the costal area.

<sup>249</sup> Record probably based on a male of true *cordillerae*.

<sup>250</sup> Selected as type locality by Hebard (Trans. Amer. Entom. Soc., XLV, p. 131, footnote, (1919)).

<sup>251</sup> See footnote number 15, under *Musonia surinama*.



Between Monte Redondo and Sabanillas de Pirrís, Candelaria Valley. Approximately 3000 feet elevation. August 18, 1927. (Rehn; swept from vines along trail.) One female.

San José. April, 1902; October, 1904. (P. Biolley.) Two females. [A.N.S.P. and Hebard Collection.]

Rio Maria Aguilar, near San José. Elevation, 3620 feet. August 30, 1923. (Tristán and Rehn; swept from low foliage.) One immature female.

In addition to these specimens I have before me the male and female from Piedras Negras and the female from Turrialba previously reported.

When this form was originally described the authors stated, "It is not unlikely that *A. vitrea* may prove to be a pallid male variety of *A. mexicana*." In 1919 Hebard<sup>252</sup> stated *vitrea* might "represent a geographic race of *cordillerae*, or merely a recessive extreme of coloration found in that species", while in 1924<sup>253</sup> the same author definitely used *vitrea* in a subspecific sense, speaking of it as a geographic race. The material now before me definitely supports this conclusion. True *cordillerae* is Mexican, probably reaching the higher levels of Guatemala, replaced southward by *A. cordillerae vitrea* as here detailed.

The synonymic history of this subspecies, as well as that of the typical form, illustrates clearly the uncertainty previous authors felt regarding the correlation of sexes of *cordillerae* and other species. The records of this subspecies from Costa Rica as both *mexicana* and *vitrea* were due to my early efforts to follow fully and consistently Saussure and Zehntner in their "Biologia" treatment, which increasing experience later showed was exceedingly faulty in innumerable respects.

With a series of twenty-five individuals, representing both sexes of the two races, before me, including a female from Cordoba, Vera Cruz, Mexico, authentically determined by Saussure and Zehntner as *mexicana*, being an individual of the series reported in the "Biologia", I find that *A. c. vitrea* is reasonably distinct from *A. c. cordillerae*, particularly in the male sex. Typical *vitrea* differs in the latter in the pronotum being shorter, broader and in profile with the dorsal line less sinuate; in the tegmina having the marginal field slightly narrower, the stigma less evident or subobsolete, and the whole of the tegmina outside of the marginal field and the stigmal area clear hyaline; the wings without opacity or clouding except for the greenish (or due to drying reddish) opacity of the immediate vicinity of the costal margin. In the female sex there is much less differentiation than in the male, about the only constant features of difference appearing to be that the pronotum in profile is less distinctly sinuate and the marginal field of the tegmina is faintly less regularly narrowing distad than in *A. c. cordillerae*.

<sup>252</sup> Trans. Amer. Entom. Soc., XLV, p. 131, footnote.

<sup>253</sup> Proc. Acad. Nat. Sci. Phila., LXXVI, p. 132.

Five males and five females from Mexico (Cordoba, San Rafael, and Atoyac, Vera Cruz <sup>254</sup>), now before me, are typical of *A. c. cordillerae*, while a female from the Polochic River, Guatemala (October, 1906; (G. P. Goll); [U.S.N.M.]), a male from San Pedro Sula, Honduras (February 13, 1922; (José Lienhart); [A.N.S.P.]), and another from Eden, Nicaragua; June 1, 1922; (Wharton Huber); [A.N.S.P.]) are referable to *A. c. vitrea*. From this it is evident that *A. c. vitrea* is rather broadly distributed in Central America, although we have no very definite information as to the vertical extent of its distribution except in Mexico and Costa Rica. At present, owing to the absence of fully comparable material, I do not care to make any definite statement regarding the range of *A. c. vitrea* in South America.

In Costa Rica this race occurs from the Pacific Coast eastward across the interior more elevated region, and down on the Atlantic slope at least as far as Turrialba (2000 feet). Whether it occurs over the lower levels of the Atlantic forest belt is not known. Its absence from the collections made by me two different seasons in the Guápiles region and in the Estrella Valley would seem to point to its non-occurrence so low on the Atlantic side. Seasonally in Costa Rica it occurs adult as early as April (San José), and as late as October (same locality), while the very immature individual from the Rio Maria Aguilar taken August 30, and the adult female from the Candelaria Valley little more than a score of miles southwest of the former locality, secured August 18, seem to indicate the species may be at least two brooded.

The Costa Rican individuals before me show clearly several lines of color variation, which to some extent at least are shared with *A. c. cordillerae*. One is the frequent pronounced blackish brown infuscation of the cephalic limbs, these sharply contrasting with the color of the pronotum, which is also the tone of these limbs in the bulk of the material. This phase with the infusate cephalic limbs is represented by the Pozo Azul de Pirris and Piedras Negras males, while the Las Loras and Piedras Negras females have the femora, tibiae and coxae equally infusate, but the coxae are pale greenish yellow more or less distinctly triannulate with fuscous. The general tone of the Oricuajo female is deeper green than the other Costa Rican females, with a distinct dark medio-longitudinal line on the pronotum, and the discoidal and anal fields of the tegmina more sooty infumate than in the others. The paler, more costal area of the wing of the female ranges from bright lemon yellow to dull orange, in none as truly brick red as in females of *A. c. cordillerae* from Mexico.

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<sup>254</sup> Cordoba; (Hoegel); one female; [Hebard Cln. ex Saussure]: April 5, 1908; (Fenyès); one female; [Hebard Cln.]. San Rafael; (C. H. T. Townsend); four males, three females; [Hebard Cln. and A.N.S.P.]. Atoyac; November, 1887; one male; [Hebard Cln.].

Nothing definite is known concerning the habits of this form other than the notes given above with the specific records of material.

### TITHRONE Stål

*Tithrone* Stål, Bihang till K. Svenska Vet. Akad. Handlingar, IV, no. 10, pp. 42, 62, (1877).

Genotype (by monotypy).—*Acontista roseipennis* Saussure.

This genus consists of a single species, which is distributed from the Guianas westward to Colombia and eastern Costa Rica, and also occurs on the island of Trinidad.<sup>255</sup>

***Tithrone roseipennis* (Saussure).**

*Acontista roseipennis* Saussure, Mitth. Schw. Entom. Gesell., III, p. 229, (1870), [♀; Guiana].

*Acontista mexicana* Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 794, (1906), [♀; Carrillo, Costa Rica]. (Not *Acontista mexicana* Saussure and Zehntner (= *Acontiothespis c. cordillerae* (Saussure).)

The Carrillo female is now before me and its proper reference is at once evident. No material of *Tithrone*, or of true *A. cordillerae* (*mexicana*) was available when the above cited erroneous determination was made.

Comparison of this specimen with Guiana and Trinidad material shows no feature of difference worthy of note. The apical blackish margining of the wing mentioned in the original description is quite distinct in the Guianan female seen, less evident in a Venezuelan one, and represented by the merest traces in the Costa Rican specimen. In males before me I find it marked in that from Charvein, French Guiana, weakly indicated in one from San Esteban, Venezuela,<sup>256</sup> and evident to a variable degree in two

<sup>255</sup> Giglio-Tos (Das Tierreich, Lief. 50, p. 508, (1927)) separated the Trinidad insect (*T. trinitatis*) on the basis of slightly smaller size, the yellowish instead of rose colored wings, and the absence in the male sex of a black band across the vertex. He had before him only males (or a male?) from Trinidad. Apparently there is little or no warrant for the recognition of *trinitatis* as distinct from *roseipennis*, the type locality of which is Guiana, and probably specifically Cayenne (see Mém. Hist. Nat. Mex., IV (Mex. Mant.), p. 40, (1871)). I now have before me a pair of *roseipennis* from Charvein (♂) and Nouveau Chantier (♀), French Guiana (=Cayenne), other material of both sexes from Venezuela and Colombia, that here reported from Costa Rica, as well as a pair (Heights of Aripo; August and September 1-8, 1909; (M. A. Carriker, Jr.)) and a single female (Brasso; August 23, 1930; (G. Baltmontes); [Hebard Cln.]) from Trinidad. The latter specimens show conclusively that the size feature given by Giglio-Tos has no meaning, as the three before me from Trinidad are no smaller than individuals of both sexes from mainland localities, while the wings in all three specimens are strongly rose colored, and in no degree yellowish. The Heights of Aripo male does, however, lack a marked black bar across the vertex, although this bar is indicated by scattered black points, while mainland males show a definite amount of variation in the depth and solidity of this bar. It may be that *trinitatis* was based on a single recessively colored male, in which the wing color, by such recession, was yellowish, and correlated with this condition of pattern depth, or independent of the same, the black bar was completely absent from the vertex. Furthermore a specimen discolored by too lengthy exposure to cyanide fumes would have a normal rose color changed to yellowish. Under the circumstances the name *trinitatis* appears unnecessary, being based on the merest color variant of *roseipennis*, the other features originally given not being diagnostic of Trinidad material.

<sup>256</sup> San Esteban, Venezuela; October-November, 1910; (M. A. Carriker, Jr.).

from Colombia.<sup>257</sup> Apparently this is an individual feature, probably in part at least geographically correlated, but of no taxonomic significance.

This beautiful rosy-winged mantis is a native of the most northern portion of South America, not occurring, as far as known, south of the Amazon, and entering Central America only in the eastern section of the Tropical Zone of Costa Rica. Doubtless, however, it will be found more widely distributed over the eastern portion of the latter country, as Carrillo (now non-existent) was at an elevation of 374 meters (1227 feet) above the sea. Its occurrence as high as 7500 feet at La Palmeta in Santander, Colombia, indicates it there reaches into the Subtropical Zone. From present information it is not possible to assume whether it does or does not reach the same zone in Costa Rica, but its absence from collections made on the Meseta Central apparently shows its range within the country is limited.

#### EPAPHRODITINAE

##### METILIA Stål

*Metilia* Stål, Bihang K. Svenska Vet. Akad. Handl., IV, no. 10, pp. 84, 89, (1877).

Genotype (by monotypy).—*M. integra* Stål (= *Acanthops brunnerii* Saussure).

This genus contains but a single species, which was previously unknown from Central America. The female sex is markedly different in appearance from the male, as is true of all the members of the Epaphroditinae.

***Metilia brunnerii* (Saussure).**

*Metilia brunnerii* Saussure, Mém. Hist. Nat. Mex., IV (Mém. Mex. Mant.), pp. 141, 144, (1877); [♀; Surinam].

*M[etilia] integra* Stål, Bihang K. Svenska Vet. Akad. Handl., IV, no. 10, pp. 84, 89, (1877), [♂; Brazil].<sup>258</sup>—Westwood, Rev. Mantid., p. 45, pl. IX, fig. 9, (1899), [♂; Santarem, Brazil].

*Acanthops adusta* Gerstaecker, Mitth. Naturw. Ver. Neu-Vorpomm. und Rügen, Greifswald, XX, p. 57, (1889), [♂; Iquitos, Amazonian Peru].

La Florida, Rio Reventazón.<sup>259</sup> (C. H. Lankester.) One male.

The definite association of Saussure's *Acanthops brunnerii* and Stål's *Metilia integra* as sexes of the same species was recently made by Beier,<sup>260</sup> presumably with the type material of Saussure's species before him.

<sup>257</sup> La Palmeta, 7500 feet, Santander, Colombia; July 15–20, 1916; (M. A. Carriker, Jr.); one male; [Hebard Cln.]. Santa Elena, Antioquia, Colombia; September 14, 1930; (C. H. Ballou); one male. (See Hebard, Trans. Amer. Entom. Soc., LIX, p. 30, (1933).)

<sup>258</sup> This type has been figured by Sjöstedt (Arkiv för Zoologi, XXI A, no. 32, pl. 15, fig. 4, (1930)).

<sup>259</sup> This locality is a small station on the railroad line from Limón to San José, near the east base of the Volcán de Turrialba. It is approximately five miles beyond La Junta, and at an elevation of about 200 meters above sea-level. The forest conditions are those of the lower level of the eastern rain-forest section of the Tropical Zone.

<sup>260</sup> Zoolog. Anzeiger, LXXXI, p. 253, (1929).

Chopard some years ago,<sup>261</sup> however, had indicated that *brunnerii* was referable to *Metilia*.

A female specimen from St. Laurent du Maroni, French Guiana, being one of three females recorded as *Acanthops brunnerii* by Chopard,<sup>262</sup> and received in exchange from him, convinces me of the propriety of the association made by Beier.

The synonymy of Gerstaecker's *adusta* is clearly evident, the unique type now being before me.

With five males of *brunnerii* from Amazonian Brazil and British Guiana,<sup>263</sup> and the type of Gerstaecker's *adusta*, as well as the La Florida individual and five Nicaraguan males<sup>264</sup> now before me, it is evident that but a single species is represented, although there is a very definite amount of size variation. The Central American individuals in their entirety are appreciably larger than the others, while that from Iquitos (the type of *adusta*) is even smaller than those from the Guianas and lower Amazonia, which are less in size than those from Costa Rica and Nicaragua. These differences are evident in the dimensions of representative individuals given below. The whole series now before me also exhibits appreciable variation in the relative tegminal length, and also in the width of the expanded portion of the marginal field of the tegmina, as well as the exact curvature of the distal section of the margin of the same field. These latter fluctuations, however, seem less correlated geographically than the general size variation above noted. Beier in his comments on this species already mentioned, has redescribed and furnished measurements of both sexes. Representative males from the specimens in hand, discussed above, show the following dimensions (in millimeters).

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen	Greatest width of marginal field of tegmen <sup>265</sup>
♂, Great Falls, Nicaragua .....	33.5	10	3	33.8	11.5	4.3
♂, La Florida, Costa Rica .....	36.2	10.4	3.2	33.1	12.5	4.6
♂, Tumatumari, British Guiana .....	34	9.2	2.9	28.6	11.6	3.8
♂, Pará, Brazil .....	31.2	9.3	3.1	30.8	11.3	4.1
♂, Iquitos, Peru (type of <i>adusta</i> Gerstaecker).	30.4	9.4	2.7	25.5	9.9	3.6

<sup>261</sup> Bull. Soc. Entom. France, 1913, p. 60, (1913).

<sup>262</sup> Ann. Soc. Entom. France, LXXX, p. 335, (1911).

<sup>263</sup> Pará, Pará, Brazil; III, 1919; (Dyer); one male. Kartabo, British Guiana; (W. Beebe); one male. Tumatumari, Rio Potaro, British Guiana; III and IV, 1922; three males; [A.M.N.H. and A.N.S.P.].

<sup>264</sup> Eden, Nicaragua (14° 0' N, 84° 26' W); August and August 18 and 28, 1922; (J. S. McKenzie); three males. Great Falls, Pis Pis River, ten miles N.W. of Eden, Nicaragua; April 23, 1922; (Wharton Huber); two males.

<sup>265</sup> This measurement is entirely exclusive of the humeral trunk, being merely the width of the field itself.

Apparently in Costa Rica *Metilia* occurs only in the lowest levels of the eastern rain-forest section of the Tropical Zone. La Florida is along the Rio Reventazón, in a forest belt of rather different character from that about Guápiles or localities higher up the Reventazón Valley.

The range of the species as now known extends from eastern Nicaragua (Eden and Great Falls of the Pis Pis River) at least to the Peruvian portion of Amazonia, eastward and southeastward to the Guianas, the lower Amazon and across coastal Brazil at least as far as the State of Espirito Santo, from which Beier reported a female.<sup>266</sup>

#### ACANTHOPS Serville

*Acanthops* Serville, Ann. Sci. Nat., XXII, p. 52, (1831).

*Plesiacanthops* Chopard, Bull. Soc. Entom. France, 1913, p. 55, (1913). (Genotype (by original designation).—*Acanthops tuberculata* Saussure.)

Genotype (by monotypy).—*Mantis fuscifolius* Olivier = *Acanthops falcatoria* (Goeze).

Chopard after erecting *Plesiacanthops* changed his mind as to its generic value, and considered that it and *Metilia* and *Decimia* Stål were based on characters of little importance.<sup>267</sup> I fully agree regarding *Plesiacanthops*, but, with Giglio-Tos, prefer to retain *Metilia* and *Decimia* as distinct generic units, their differential characters being as important as those used to separate numerous other generally accepted genera of mantids.

The species of *Acanthops* are exceedingly difficult to distinguish, but the past systematic treatments of the forms of the genus have been so haphazard and so little based on logical relationship that the natural difficulties have been greatly increased. With nearly all the valid species of the genus before me, and a reasonably concise knowledge of the synonymy of the various units, it is now possible to reduce the troubles encountered by the student attempting to use Giglio-Tos's treatment.<sup>268</sup> The number of valid species now known is eight, as against nine recognized by Giglio-Tos, while one of these valid species (*bidens*) was not included in the latter's work.

A brief summary of these forms and critical notes on certain synonymy is here appended.<sup>269</sup>

<sup>266</sup> Zoolog. Anzeiger, LXXXI, p. 253, (1929).

<sup>267</sup> Ann. Soc. Entom. France, LXXXV, p. 179, (1916).

<sup>268</sup> Das Tierreich, Lief. 50. pp. 512-515, (1927).

<sup>269</sup> The values I would give the forms recognized by Giglio-Tos are as follows:

*A. brunneri* (Saussure)=female of *Metilia brunneri* (see above).

*A. godmani* Saussure and Zehntner. A distinct species, near *bidens* Hebard. (See specific treatment.)

*A. falcatoria* (Goeze). A very distinct species.

*A. bolivari* Chopard. Apparently a valid species, related to *falcatoria*. This is the only form of the genus of which I am not definitely certain as to its standing.

*A. erosa* Serville. Serville's species is a synonym of *falcatoria*. The species to which Giglio-Tos applied the name is distinct. Gerstaecker's *A. contorta*, from the

The genus is distributed from Sinaloa, western Mexico and British Honduras, south across Central and South America as far as southern Brazil and southern Bolivia. Material from Chili has been credited to the genus, but I am certain it has been erroneously labelled, as *Acanthops* is a tropical and not a temperate genus, occurring in both the humid and semi-arid sections of the Tropical Zone, and in the Subtropical as well.

***Acanthops godmani*** Saussure and Zehntner. Plate 8, figures 8-10.

*Acanthops godmani* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 181, pl. VI, fig. 3, (1894), [♂; Belize, British Honduras].

*Acanthops tuberculata* Rehn, Proc. U. S. Nat. Mus., XXVII, p. 570, (1904), [immature ♀; Tucurrique], (Not of Saussure, 1870).—Giglio-Tos, Das Tierreich, Lief. 50, p. 574, (1927), [Costa Rica only of localities].

Cachi. Elevation, 3500 feet. (C. H. Lankester.) One female.

The association of this female, and other material of the same sex, with *godmani*, described from the male, has been made only after long and careful study. A male from Morales, Guatemala,<sup>270</sup> now before me, has enabled me to place the species, which can be distinguished from *falcata* Stål,<sup>271</sup> in both sexes by the more squarely transverse truncate occiput, the less rounded juxta-ocular shoulders of the same and the longer pronotum, in the female also by the mammillate paired tubercles on the collar and cephalad on the shaft of the pronotum, while in the male the venation of the discoidal field of the tegmina is sparser and different in disposition, and the internal half or so of the whole tegmen is subhyaline, and not opaque, or at most subtranslucent, as in *falcata*.

The very unusual squarely truncate occiput will at once separate this species from all the other members of the genus except *falcata* Stål and *bidens* Hebard. Of the latter species<sup>272</sup> the male sex only is known, and it is quite close to *godmani*, but readily separable by the more strongly indicated and elevated paired dentiform juxta-ocular tubercles, which, judging from the male, in the female sex must be quite decided, and more striking than the low but distinct tuberculate juxta-ocular shoulders of that sex of

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evidence of the type now before me, is a synonym of *falcataria*, and has nothing to do with the species for which Giglio-Tos used Serville's *erosa*.

*A. tuberculata* Saussure. A distinct and valid species.

*A. erosula* Stål. A distinct species near *tuberculata*.

*A. griffini* Giglio-Tos. A synonym of *falcata* as shown by Hebard (Trans. Amer. Entom. Soc., XLVIII, p. 343, (1923)).

*A. falcata* Stål. A distinct species. The synonymy of *angulifera* Westwood and *griffini* Giglio-Tos is correct.

*A. bidens* Hebard. A distinct species with *godmani* its nearest relative.

A proper linear arrangement of the previously described species of *Acanthops* would seem to be: *falcataria* (Goeze), *bolivari* Chopard, *tuberculata* Saussure, *erosula* Stål, *falcata* Stål, *godmani* Saussure and Zehntner, and *bidens* Hebard.

<sup>270</sup> October, 1930; (J. J. White); [Hebard Cln.].

<sup>271</sup> Bihang K. Svenska Vet.-Akad. Handl., IV, no. 10, p. 90, (1877), [♀; "Nova Granada (=Colombia)].

<sup>272</sup> Trans. Amer. Entom. Soc., LXVIII, p. 189, pl. VII, fig. 10-11, (1923), [♂; Venvidio, Sinaloa, Mexico].

*godmani*. The pronotum in the male of *bidens* is shorter proportionately than that of *godmani*, and this difference doubtless is reflected also in the female sex.

The Morales, Guatemala male of *godmani* now before me is appreciably larger than the type, and also has the tegminal apices bluntly more produced. Series of other species of the genus (particularly in the case of *A. falcata*) show there is a marked amount of individual and geographic size variation, even from the same locality, and similarly there is seen to be definite fluctuation in the exact shape of the tegminal apices in the males, as well as in the females. These differences, therefore, are not of fundamental importance. The description of the immature female from Tucurrique, Costa Rica, given by me in 1904 (vide supra) will in the main serve to facilitate the recognition of that sex of this species. This description erred in stating the head is slightly longer than broad, when eyes included it is broader than deep; in giving but three discoidal spines on the cephalic femora when four are present; similarly the lateral markedly lobate abdominal segments are said to be the fourth and fifth, while, counting the median segment as the first, this should read the fifth and sixth.

The following features of the female sex are additional to those already given from the Tucurrique individual. Pronotum with dorsal surface having in addition to the paired mammillate tubercles caudad on the collar and cephalad on the shaft, the usual paired nodes mesad at the caudal margin (these are mammillate), the surface of the shaft distinctly low tuberculate, a closely placed median biseriate group flanking a faint medio-longitudinal impression. Tegmina mortui-foliaceous, slightly surpassing apex of abdomen: marginal field broad proximad, sigmoidally narrowing to three-fifths of length of tegmen, in the distal two-fifths the costal margin is broadly obtuse-angulate briefly before the gently falcate caudate extremity is reached: discoidal field at broadest point no wider than marginal field at proximal fifth of tegminal length. Wings, when in repose, little surpassing the tegmina exclusive of caudate extremity, distal extremity blunt acute, there obsoletely lobulate. Median and caudal femora short, stout, compressed, ventral margins sublamellate with the border serratulose.

In coloration the Cachí female is in general dull mummy brown, becoming sepia on the head and external aspects of the cephalic limbs and dull russet ventrad internally on the cephalic femora; pronotum caudad paling to pinkish buff, the lateral lunules raw umber; tegmina uniformly mummy brown; wings dull zinc orange concentrically multilined with blackish, costal margin and apex blackish.

In addition to the Cachí female I have before me an adult female of this, identical in all respects with that from Costa Rica, from Naranjal, southwestern Ecuador.<sup>273</sup>

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<sup>273</sup> (F. Campos).



The measurements (in millimeters) of all three specimens of *godmani* examined, as well as those of Saussure and Zehntner of the male type, are as follows:

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of marginal field of tegmen	Greatest width of abdomen across broadest lobes	Length of cephalic femur
♂, Belize, Brit. Honduras, <i>type</i> , ex Saussure and Zehntner .....	33	11	—	32.5	—	—	9.25
♂, Morales, Guatemala ....	44.5	12.9	3.8	40	5	11.5+ <sup>274</sup>	11.8
♀, Cachi, Costa Rica .....	42	14.3	5.7	30	5.9	20	14.3
♀, Naranjal, Ecuador .....	41	15	5.3	29.6	5.5	17+ <sup>274</sup>	14.1

From the material now available it is evident that the distribution of *godmani* extends from British Honduras (Belize) southward in Central America to the higher level of eastern Costa Rica (Cachi) and thence, farther to the southward, probably in suitable areas, to extreme south-western Ecuador. Apparently *falcata*<sup>275</sup> and *godmani* do not occur in the same areas, and the former ranges from the Canal Zone section of Panama and eastern Colombia eastward to the Guianas and Trinidad. Future work alone will show to what extent the two species supplement one another, and also the areas in which the ranges of the two impinge or even overlap.

#### ACROMANTINAE

##### ANTEMNA Stål

*Antemna* Stål, Bihang till K. Svenska Vet. Akad. Handl., IV, no. 10, pp. 83, 88, (1877).

*Phyllomantis* Saussure, Societas Entomologica, VII, p. 124, (1892). (Based on *P. laurifolia* Saussure.)

*Neacromantis* Beier, Mitth. Zool. Staatsinst. u. Zool. Mus. Hamburg, XLV, p. 19, (1931). (Based on *N. costaricensis* Beier.)

Genotype (by monotypy).—*Antemna rapax* Stål.

This very striking and distinctive genus is the sole representative of the Acromantinae known from the New World. It is a typical member of that group, as shown by the characteristic form of the head and vertex, pronotum and cephalic, median and caudal femora. Beier, when describing *Neacromantis*, was the first to recognize its true position, previous authors having considered it a member of the Mantinae, of which Giglio-Tos considered *Phyllomantis* to be a monotypic group, the Phyllomantes.

<sup>274</sup> Lobe of one side recurved or decurved.

<sup>275</sup> Sjöstedt recently published (Arkiv för Zoologi, 21 A. no. 32, p. 13, pl. 14, fig. 4, (1930)) a photograph of the unique type of *falcata*.

The genus would fall into the Group *Acromantes*, but the facial scutellum lacks a dorsal angle or protuberance, as found in genera of that group which I have examined, while the very great width of the marginal field of the tegmina is exceptional. In consequence it is necessary for consistency's sake to erect a Group *Antemnae* to include it, placing it next to the *Acromantes*.

A careful study of the original information given for *Antemna*, the more recent figure by Sjöstedt of the type specimen of the genotype of that genus, referred to below, the descriptions of *Phyllomantis* and of *Neacromantis*, and the two female individuals now before me, leaves no doubt as to the synonymy established above.

Stål's *Antemna* was based on a female individual with very short and rudimentary tegmina, considered by that author to be a "pupa". Saussure and Zehntner<sup>276</sup> and Giglio-Tos,<sup>277</sup> apparently following Stål, considered this type to be immature, but Sjöstedt states this is incorrect, and that instead it is an adult female, to emphasize which conclusion he figures one of the brief lobate tegmina. Sjöstedt's argument is pointless, however, as the instar preceding maturity in numerous mantids shows tegminal pads exceedingly similar to those figured by him. From his illustration, the correlation in all other features of two adult females, and my experience with mantids in general, I have no hesitation in supporting Stål's original conclusion that the type of *A. rapax* is immature.

Beier's *Neacromantis* was based on the adult male, which in the details of its description reveals quite clearly coincidence in the numerous ambisexual features.

The generic distribution is that of the sole species.

#### ***Antemna rapax* Stål.**

*Antemna rapax* Stål, Bihang till K. Svenska Vet. Akad. Handl., IV, no. 10, p. 88, (1877), [♀; Chiriqui, [Panama]].—Sjöstedt, Arkiv för Zoologi, XXIA, no. 32, p. 13, pl. 14, figs. 5-5A, (1930), [figure of type specimen].

*Phyllomantis laurifolia* Saussure, Societas Entomologica, VII, p. 124, (1892), [♀; [Bugaba], Panama]; Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 183, pl. VI, figs. 6 and 7, (1894), [♀; Bugaba, Panama].

*Neacromantis costaricensis* Beier, Mittheil. Zool. Staatsinst. u. Zool. Mus. Hamburg, XLV, p. 19, (1931), [♂; Hamburg Farm, Rio Reventazón, Costa Rica].

Las Ánimas, Rio Reventazón.<sup>278</sup> April 17, 1930. (C. H. Lankester.)

Pozo Azul de Pirris. (M. A. Carriker, Jr.) One female. [Hebard Cln.]

The figures and descriptions, referred to above, present the features of both sexes of this very unusual mantid, which possesses no known American relative.

<sup>276</sup> Biol. Cent.-Amer., Orth., I, p. 182, (1894).

<sup>277</sup> Das Tierreich, Lief. 50, p. 517, (1927).

<sup>278</sup> See footnote 127 under *Stagmomantis heterogamia*.

Both specimens now in hand are slightly larger than the detailed measurements of the adult female given by Saussure and Zehntner, showing the following dimensions (in millimeters):

	Length of body	Length of pronotum	Greatest width of pronotum	Length of tegmen	Greatest width of tegmen	Width of marginal field of tegmen	Length of cephalic femur
♀, Las Ánimas ...	68.3	19.7	10	37.5	21	12	18.2
♀, Pozo Azul ....	64.5	19.8	10	38	21.1	11.4	18.2

The species is apparently rare in nature, as the five specimens mentioned, i. e. the types of the three names proposed for this species, and the two here recorded, seem to be all which have been taken. It is found in both the humid Atlantic portion of the Tropical Zone and the Pirris section of the Pacific Tropical, possibly not occurring in the drier areas on the Pacific side. Nothing is known regarding the habits of the species other than that at the three Costa Rican localities it was taken in areas which are predominately of heavy forest, and at Hamburg Farm specifically on bush at night. It is quite possible that *Antemna* is nocturnal. The known dates for its capture are April 17 (Las Ánimas) and June 10 (Hamburg Farm).

#### VATINAE

##### PHYLLOVATES Kirby

*Phyllovates* Kirby, Syn. Catal. Orth., I, p. 302.

Genotype (by original designation).—*P. chlorophaea* (Blanchard).

This genus of eight or more species is distributed from the extreme southern United States (southern Texas) and northwestern Mexico (Sinaloa) south to southern Brazil, Paraguay, and northern Argentina. But two species are definitely known from Central America, the genotype and *P. tripunctata* (Burmeister), the latter not occurring north of Panama as far as at present known. The species much resemble those of the genus *Vates*, which is discussed on a subsequent page, but lack the characteristic limb lobes of the latter genus.

##### *Phyllovates chlorophaea* (Blanchard).

*M[antis] chlorophaea* Blanchard, Magasin de Zool., V, Ins., pl. 135, (1836),<sup>279</sup> [♀; Watertown, New York (in error)].

*Th[eoelytes] azteca* Saussure, Revue et Magasin de Zool., (2), XI, p. 61, (1859), [♂; Mexico].

*Theoelytes mexicana* Saussure, Revue et Magasin de Zool., (2), XIII, p. 127, (1861), [♀; Cordoba, "Mexico calida"].

[*Theoelytes chlorophaea*] var. *cornuta* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 191, (1894), [♀; Localities not separated from those of typical *chlorophaea*, and include Costa Rica].

<sup>279</sup> The date of this publication is usually given as 1835 from the volume title page. The individual article, however, is dated February, 1836, and a prefatory note to the volume explains that the various contributions in it appeared over a period of three years.

*Theoclytus maya* Saussure and Zehntner, Biol. Cent.-Amer., Orth., I, p. 192, pl. X, fig. 33 (legend as *T. chlorophaea* var.), (1894), [♂, ♀; Tabasco, Mexico; Temax, north Yucatan].

*Theoclytus cornuta* Giglio-Tos, Bollett. Mus. Zool. Anat. Comp. Torino, XXIX, no. 684, p. 41, (1914), [♂; Costa Rica].—Giglio-Tos, Das Tierreich, Lief. 50, p. 604, (1927), [Costa Rica].

*Theoclytus chlorophaea* Hebard, Trans. Amer. Entom. Soc., XLVIII, p. 345, (1923), [♂; Costa Rica; ♀; San José, Pozo Azul and Siquirres, Costa Rica].

Siquirres, July 31, 1903. One female. [Hebard Cln.]

Cachí. (C. H. Lankester.) One male.

San José. Elevation, 1161 meters. (P. Biolley.) Two males, one female. [Hebard Cln.]

Escazú. October 1902. One immature male.

Pozo Azul de Pirris. (M. A. Carriker, Jr.) One female. [Hebard Cln.]

"Costa Rica." (Carriker, Lankester, Heyde and unknown collectors.)

Five males.

The synonymy of *azteca* and *mexicana* was conceded by Saussure and Zehntner,<sup>280</sup> and that of *cornuta* and *maya* as mere individual variants of *chlorophaea* was established by Hebard.<sup>281</sup>

The measurements already given by Hebard<sup>281</sup> illustrate quite clearly the marked individual variation found in this species, even at a single locality. The relative length of the cephalic coxae and the metazona of the pronotum is seen from the Costa Rican material to vary markedly in both sexes, and to be without value in separating the conditions to which Giglio-Tos continued to apply the names *cornuta* and *maya*.

It is evident from a series of eight males from Venvidio, Sinaloa, Mexico, now before me, that the frontal processes individually vary somewhat in length, and distinctly so in whether their apices are parallel and acuminate or somewhat diverging and subfalcate. The Siquirres female has these processes longer than in any other female seen, but this may have a definite correlation with the very elongate pronotum of that individual. The number of females available for examination, however, is not large enough to reach any definite conclusion in this respect.

In distribution *chlorophaea* is known to range from as far north as extreme southern Texas (Brownsville) and Sinaloa, Mexico (Venvidio), south to at least Honda, Tolima, and Fusugasugá, Cundinamarca, Colombia. We have no information as to the extent of the species distribution in South America eastward of the last mentioned locality.

Apparently the species is widely distributed in Costa Rica, occurring from the low Atlantic rain-forest district at Siquirres to as high as over 1100 meters on the Meseta Central at San José, and on the Pacific slope down to but a few hundred feet elevation at Pozo Azul de Pirris. Our

<sup>280</sup> Biol. Cent.-Amer., Orth., I, p. 191, (1894).

<sup>281</sup> Trans. Amer. Entom. Soc., XLVIII, pp. 344-345, (1923).

information is too fragmentary to show anything concerning the seasonal presence of the species, and nothing is known or recorded concerning the binomics of this insect.

#### VATES Burmeister

*Vates* Burmeister, Handb. der Entom., II, Abth. II, pt. 1, p. 543.

*Theoclytes* Serville, Hist. Nat. Ins., Orth., p. 150. (Restricted to *Mantis foliata* Lichtenstein by Kirby.)<sup>282</sup>

Genotype (by designation of Rehn, 1901<sup>283</sup>).—*V. cnemidotus* Burmeister (= *lobata* (Fabricius)).

Two schools of thought exist as to the scope of the present genus, one placing within it nearly twenty species, which in distribution extend from southern Arizona to Brazil, Bolivia and Peru, and the other limiting *Vates* to about ten species found over almost the same area. Those who limit *Vates* to the fewer number of species, place the others under the generic name *Pseudovates* Saussure.<sup>284</sup> Whether the features on which the latter name was based are sharply cut enough to characterize a distinct genus, or pass so evenly and gradually into the condition of typical *Vates* that generic division cannot clearly be indicated, remains to be determined. The sole Costa Rican species is, under any circumstance, a true *Vates*.

Very little is known regarding the habits of the striking and specialized species which belong to *Vates* (and *Pseudovates*), and the systematic relationship of the various forms is not well understood. The relative scarcity of female individuals from certain regions also makes difficult the proper arrangement of the species.

**Vates pectinicornis** (Stål). Plate 7, figure 26; plate 8, figures 11 and 12.

*T[heoclytes] pectinicornis* Stål, Bihang K. Svenska Vet. Akad. Handl., IV, no. 10, p. 73, (1877), [♂; Chiriqui [Panama]].

*Theoclytes* (sic) (*Vates*) *pectinicornis* Sjöstedt, Arkiv för Zoologi, 21 A, no. 32, p. 14, pl. 17, fig. 3, (1930), [Figure of Stål's type].

Pozo Azul de Pirris. August 20 and 23, 1927. (Lankester and Rehn; at light at night.) Four males.

This beautiful mantid is rather broadly distributed in Central America, although the references to it in the literature are only the two given above. Apparently it is in but few collections, and the female sex remains unknown. I now have before me eleven males from four different sections of Central America, these in addition to Pozo Azul being: Rio Grande, British

<sup>282</sup> Scient. Proc. Royal Dublin Soc., VI, p. 568, (1890). In 1901 (Canad. Entom., XXXIII, p. 24) I indicated *chlorophaea* as the type of *Theoclytes*, and used it for the genus to which the name *Phyllovates* is here applied. At that time, however, I had overlooked Kirby's prior fixation, which definitely made *Theoclytes* a synonym of *Vates*.

<sup>283</sup> Canad. Entom., XXXIII, p. 24, (1901). Kirby, in the paper referred to in the above footnote, gave merely the names of the species included in *Vates* and failed to indicate a single type species.

<sup>284</sup> Mitth. Schw. Entom. Gesell., III, pp. 53, 60, (1869). Type (by monotypy).—*Vates tolteca* Saussure.

Honduras; <sup>285</sup> Morales, Guatemala, <sup>286</sup> and Eden, <sup>287</sup> and Great Falls of the Pis Pis River, <sup>288</sup> Nicaragua.

Apparently *pectinicornis* is more nearly related to *lobata* (Fabricius), a Guianan and Brazilian species, than it is to any other known to me from material. The form of the pronotum suggests that of the Mexican *V. pectinata* Saussure, agreeing in this respect more nearly with the latter than with *lobata*, but the characters of the cephalic femora, the lobation of the caudal femora and the sigmoid form of the pectination of the individual antennal articles are more nearly as in *lobata*.

Sjöstedt's illustration of the type must be used with caution, as this photograph does not make clear the extent to which the dorso-proximal lobe on the median tibiae, and the same lobe on the caudal tibiae are there foreshortened.

The green of the marginal field of the tegmina varies in tone from as pale as Scheele's green to as dark as meadow green, occasionally darker along the humeral trunk than nearer the costal margin. The shaft of the pronotum may be as light as calliste green or as dark as parrot green, while in certain individuals the pronotum is largely dull buffy or orange-ocher with traces of greenish. The latter condition may be due, at least in some degree, to desiccation, but not entirely so, as the material in question has been carefully prepared and not otherwise discolored.

There is slight but appreciable variation in the acuteness of the apices of the paired frontal processes, also in the extent to which they diverge distad.

A representative male from Pozo Azul measures as follows: length of body, 51 mm.; length of pronotum, 19.5; greatest width of pronotum, 4.2; length of metazona, 16.4; length of tegmen, 39; greatest width of marginal field of tegmen, 1.9; length of cephalic femur, 11.

From present information the species is seen to range from British Honduras (Rio Grande) south to Chiriqui Province, western Panama. It apparently occurs in a variety of conditions, but except in Costa Rica and Panama is known only from the eastern rain-forest portion of the Tropical Zone. At Pozo Azul, in western Costa Rica, it came to light at night at a camp in the rather heavy forest characteristic of the low levels of the Rio Pirris, a distinctive type of country in which occur many peculiarly west coast types and others related to forms of the rain-forest district of eastern Costa Rica and Panama. There is no information available as to the portion of the Province of Chiriqui, Panama, from which came the type.

Seasonally, from present information, *pectinicornis* is known to occur adult from May to October.

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<sup>285</sup> October, 1931; (J. J. White); one male; [Hebard Cln.].

<sup>286</sup> June and July, 1929, October, 1930; (J. J. White); three males; [Hebard Cln.].

<sup>287</sup> June 4, 1922; (Wharton Huber); one male.

<sup>288</sup> May 23 and 26, 1922; (Wharton Huber); two males.

## EXPLANATION OF PLATES 7-10

## PLATE 7.

- Fig. 1.—*Mionycoides ferum* (Saussure and Zehntner). Female. La Emilia, Costa Rica. Dorsal view of pronotum. ( $\times 2$ .)
- Fig. 2.—*Mionycoides ferum* (Saussure and Zehntner). Female. La Emilia, Costa Rica. Cephalic femur. ( $\times 2\frac{1}{2}$ .)
- Fig. 3.—*Mionycoides ferum* (Saussure and Zehntner). Male. Estrella Valley, Costa Rica. Dorsal view of pronotum. ( $\times 3$ .)
- Fig. 4.—*Thrinaconyx kirschianus* Saussure and Zehntner. Male. Navarro, Costa Rica. Dorsal view of pronotum. ( $\times 5$ .)
- Fig. 5.—*Thrinaconyx kirschianus* Saussure and Zehntner. Male. Navarro, Costa Rica. Cephalic femur. ( $\times 5$ .)
- Fig. 6.—*Pseudomiopteryx infusata* Saussure and Zehntner. Male. La Florida, Costa Rica. Dorsal view of pronotum. ( $\times 6$ .)
- Fig. 7.—*Pseudomiopteryx infusata* Saussure and Zehntner. Male. Escazú, Costa Rica. Dorsal view of pronotum. ( $\times 6$ .)
- Fig. 8.—*Thesprotia insolita*, new species. Male (type). La Fortuna, Costa Rica. Cephalic view of head. ( $\times 8$ .)
- Fig. 9.—*Thesprotia insolita*, new species. Male (type). La Fortuna, Costa Rica. Dorsal view of pronotum. ( $\times 3$ .)
- Fig. 10.—*Thesprotia insolita*, new species. Male (type). La Fortuna, Costa Rica. Cephalic tibia and distal extremity of cephalic femur (external face). (Greatly enlarged.)
- Fig. 11.—*Thesprotia insolita*, new species. Male (type). La Fortuna, Costa Rica. Ultimate abdominal tergite (supra-anal plate). ( $\times 5$ .)
- Fig. 12.—*Carrikerella empusa*, new species. Male (type). Peralta, Costa Rica. Outline of occiput as seen in cephalic aspect. ( $\times 6$ .)
- Fig. 13.—*Carrikerella empusa*, new species. Male (type). Peralta, Costa Rica. Dorsal view of cephalic process. ( $\times 5$ .)
- Fig. 14.—*Stagmomantis nahua* Saussure. Male. San José, Costa Rica. Apex of dorsal sinistral valve of genitalia (in caudal aspect). (Greatly enlarged.)
- Fig. 15.—*Stagmomantis nahua* Saussure. Male. San José, Costa Rica. Apex of ventral sinistral valve of genitalia (from dorsum). (Greatly enlarged.)
- Fig. 16.—*Stagmomantis vicina* Saussure. Male. Cantarranas, Honduras. Apex of dorsal sinistral valve of genitalia (in caudal aspect). (Greatly enlarged.)
- Fig. 17.—*Stagmomantis vicina* Saussure. Male. Cantarranas, Honduras. Apex of ventral sinistral valve of genitalia (from dorsum). (Greatly enlarged.)
- Fig. 18.—*Stagmomantis centralis* Giglio-Tos. Male. Surubres, Costa Rica. Apex of dorsal sinistral valve of genitalia (in caudal aspect). (Greatly enlarged.)
- Fig. 19.—*Stagmomantis centralis* Giglio-Tos. Male. Surubres, Costa Rica. Apex of ventral sinistral valve of genitalia (from dorsum). (Greatly enlarged.)
- Fig. 20.—*Stagmomantis carolina* (Johannson). Male. Vidalia, Georgia. Apex of dorsal sinistral valve of genitalia (in caudal aspect). (Greatly enlarged.)
- Fig. 21.—*Stagmomantis carolina* (Johannson). Male. Vidalia, Georgia. Apex of ventral sinistral valve of genitalia (from dorsum). (Greatly enlarged.)
- Fig. 22.—*Stagmomantis montana montana* Saussure and Zehntner. Male. San Mateo, Costa Rica. Apex of dorsal sinistral valve of genitalia (in caudal aspect). (Greatly enlarged.)
- Fig. 23.—*Stagmomantis montana montana* Saussure and Zehntner. Male. San Mateo, Costa Rica. Apex of ventral sinistral valve of genitalia (from dorsum). (Greatly enlarged.)
- Fig. 24.—*Stagmomantis theophila* Rehn. Male. Philadelphia South, Costa Rica. Apex of dorsal sinistral valve of genitalia (in caudal aspect). (Greatly enlarged.)
- Fig. 25.—*Stagmomantis theophila* Rehn. Male. Philadelphia South, Costa Rica. Apex of ventral sinistral valve of genitalia (from dorsum). (Greatly enlarged.)
- Fig. 26.—*Vates pectinicornis* (Stål). Male. Morales, Guatemala. Section of antenna showing sigmoid character of pectinations. (Greatly enlarged.)

PLATE 8.

- Fig. 1.—*Carrikerella empusa*, new species. Male (type). Peralta, Costa Rica. Dorsal view of head and pronotum. ( $\times 2$ )
- Fig. 2.—*Xystropeltis lankesteri*, new genus and species. Male (type). Cachi, Costa Rica. Dorsal view of head and pronotum. ( $\times 2$ )
- Fig. 3.—*Xystropeltis lankesteri*, new genus and species. Male (type). Cachi, Costa Rica. Lateral view of head, pronotum and cephalic limb. ( $\times 2$ )
- Fig. 4.—*Liturgousa annulipes* (Serville). Male. Costa Rica. Dorsal view of head and pronotum. ( $\times 2$ )
- Fig. 5.—*Liturgousa maya* Saussure and Zehntner. Male. Surubres, Costa Rica. Dorsal view of head and pronotum. ( $\times 2$ )
- Fig. 6.—*Melliera chorotega*, new species. Male (type). Oricuajo, Costa Rica. Dorsal view of head and pronotum. ( $\times 3$ )
- Fig. 7.—*Melliera chorotega*, new species. Male (type). Oricuajo, Costa Rica. Lateral view of head, pronotum and cephalic limb. ( $\times 3$ )
- Fig. 8.—*Acanthops godmani* Saussure and Zehntner. Male. Morales, Guatemala. Dorsal view. (Natural size.)
- Fig. 9.—*Acanthops godmani* Saussure and Zehntner. Female. Cachi, Costa Rica. Dorsal view. (Natural size.)
- Fig. 10.—*Acanthops godmani* Saussure and Zehntner. Female. Cachi, Costa Rica. Cephalic view of head. ( $\times 2$ )
- Fig. 11.—*Vates pectinicornis* (Stål). Male. Morales, Guatemala. Dorsal view of head and pronotum. ( $\times 2$ )
- Fig. 12.—*Vates pectinicornis* (Stål). Male. Morales, Guatemala. Lateral view of head, pronotum and cephalic limbs. ( $\times 2$ )

PLATE 9.

- Fig. 1.—*Choeradodis rhombicollis* (Latreille). Male. Great Falls of the Pis River, Nicaragua. Dorsal view of pronotum. (Natural size.)
- Fig. 2.—*Choeradodis rhombicollis* (Latreille). Male. Eden, Nicaragua. Same view and size as Fig. 1.
- Fig. 3.—*Choeradodis rhombicollis* (Latreille). Male. Eden, Nicaragua. Same view and size as Fig. 1.
- Fig. 4.—*Choeradodis rhombicollis* (Latreille). Male. Cachi, Costa Rica. Same view and size as Fig. 1.
- Fig. 5.—*Choeradodis rhombicollis* (Latreille). Male. Cachi, Costa Rica. Same view and size as Fig. 1.
- Fig. 6.—*Macromantis hyalina* (DeGeer). Male. Eden, Nicaragua. From life; courtesy of Mr. Wharton Huber. (Half natural size.)
- Fig. 7.—*Stagmomantis centralis* Giglio-Tos. Male. Surubres, Costa Rica. Dorsal view. ( $\times 1\frac{1}{2}$ .)

PLATE 10.

- Fig. 1.—*Stagmomantis carolina* (Johannson). Female. Cachi, Costa Rica. Dorsal view. Green phase; general coloration yellowish green, wing tessellate with yellow. (Natural size.)
- Fig. 2.—*Stagmomantis carolina* (Johannson). Female. San José, Costa Rica. Dorsal view. Brown phase; wing with discoidal field suffused with wine purple, blackish tipped, radiate field washed with brownish olive, tessellate with yellow. (Natural size.)
- Fig. 3.—*Stagmomantis montana montana* Saussure and Zehntner. Female (type of *Stagmatoptera typhon*). San Marcos, Nicaragua. Dorsal view. (Natural size.)
- Fig. 4.—*Stagmomantis theophila* Rehn. Female (paratype of *Stagmatoptera insatiabilis*). Turrialba, Costa Rica. Dorsal view. (Natural size.)



## THE FAUNA OF BURNET CAVE, GUADALUPE MOUNTAINS, NEW MEXICO

BY C. BERTRAND SCHULTZ AND EDGAR B. HOWARD.

### INTRODUCTION

This paper is based on the fossil vertebrate remains collected from Burnet Cave,<sup>1</sup> Eddy County, New Mexico, by a joint expedition of the University Museum of Philadelphia, and the Academy of Natural Sciences of Philadelphia, during the seasons from 1930 to 1933. Sixty-two forms have been identified, including two reptiles, seventeen birds, and forty-three mammals. Three of the mammals are recognized as new and are herein described. This fauna is especially interesting since it was found in association with hearths and a Folsom-like artifact (Plate 11, fig. 2).

The cave, in which this material was found, was brought to the attention of the members of the expedition by R. M. Burnet of Carlsbad, New Mexico, in whose honor the cave was named. It is located in southeastern New Mexico on the east slope of the Guadalupe Mountains, some fifty miles, by road, west of the town of Carlsbad. The elevation of the cave above sea-level is 4600 feet. The entrance, which faces east of south, is about seventy feet above the floor of the canyon.

A diagrammatic outline and more detailed description of the cave has already been published.<sup>2</sup> The long continued accumulation of wind-blown dust together with the rock fragments, which had fallen from the roof and walls, filled the cave to within three feet of the inner roof, making the depth of dirt and debris at this point approximately nine feet. The floor of the cave slopes up toward the rear, so that in places where the wall rock shelves, the dirt was only two or three feet deep. The dimensions of the cave were found to be roughly fifty feet from the entrance to the rear wall, and thirteen feet in width at a point where the talus slope began inside the entrance. Directly under the outer overhang the height was approximately twenty-five feet.

Local collectors had discovered several burials in this cave, recovering baskets, fragments of netting, hide and sandals. They reported that the entrance had been walled when they first discovered the cave. Therefore, while the surface of the cave showed disturbance in several places, most of the deposited material was still *in situ*. In the upper two or three feet were found a number of burials of a people whose cultural remains correspond closely to those of the Basket Makers of the San Juan region of Utah.

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<sup>1</sup> Howard, 1931, 1932, 1935.

<sup>2</sup> Howard, 1935, Plate XIV.

Aside from the sandal types, which differ from the typical Basket Makers and the fact that the human remains were cremated instead of being buried in flexed positions in stone-lined cysts, most of the other traits are similar. No corn and no pottery were found in Burnet cave. In addition to baskets, beads, pieces of atlatl, bone and stone tools, a well-made twined-woven bag was recovered.

Below the burial level many hearths or lens-shaped deposits of charcoal and ashes were found at various levels down to a depth of eight feet six inches. Also in these lower levels were found the bones of the sixty-two different kinds of animals, which were, in a number of cases, associated directly with the hearths. A large number of the bones were broken, and chemical analyses made by Dr. W. M. McNab and Dr. C. K. Deischer, of the Department of Chemistry of the University of Pennsylvania, revealed that some of the bones from the cave had been burned.

Directly under a large rock a hearth was found which contained a grooved spear-point (Plate 11, fig. 2) associated with bones of an extinct bison (*Bison antiquus taylori*) and an extinct muskox (*Preptoceras sinclairi neomexicana*). This artifact, which represents a specialized Folsom-like type of point, was unlike those associated with the people who had used the cave to bury their dead. The particular hearth layer in which the artifact was found was about four feet below the nearest burial. Three bone awls were also recovered from levels below the burials. These artifacts, together with the hearths, present definite evidence of the existence of a much older culture than that represented by the cultural remains found in the Basket Maker burials. The artifacts and the large number of hearths indicate that, prior to the Basket Makers, the cave had been used over a long period at irregular intervals as a shelter or occupational cave.

With the exception of a few bird remains which are in the United States National Museum, the fossil material listed in this paper is in the Academy of Natural Sciences of Philadelphia. All specimens bear numbers of the latter institution.

#### ACKNOWLEDGMENTS

The completion of this report was made possible by the generous coöperation of Mr. Childs Frick of the American Museum of Natural History. Dr. Barnum Brown, Curator of Fossil Reptiles in the American Museum, spent a week at Burnet Cave with the expedition during 1931, and his continued interest in the problem has done much to encourage the preparation of a report on the cave.

Acknowledgments are due to the American Museum of Natural History and its departments of Vertebrate Paleontology and Mammalogy for many facilities afforded the writers, and especially to Curators Dr. Walter

Granger, Mr. H. E. Anthony, and Dr. Robert T. Hatt for the freedom of access to material under their charge.

The writers wish to express their appreciation to Dr. Malcolm R. Thorpe of the Peabody Museum of Yale University for preliminary identifications of the vertebrate material secured from the cave during 1930. Thanks are due to Dr. Erwin H. Barbour, Director of the Nebraska State Museum, and to Mr. Charles M. B. Cadwalader, Director of the Academy of Natural Sciences of Philadelphia, for their coöperation.

The writers are also indebted to Dr. A. Wetmore of the United States National Museum for his identifications of the bird bones recovered from the cave, and to Dr. C. L. Gazin of the same institution for his helpful suggestions.

Recognition is given Miss H. de Berard, Frick Laboratories of the American Museum of Natural History, for the drawing of Plate 13, figure 1.

#### LIST OF MATERIAL

##### REPTILIA (REPTILES)

1. Snake: 2 vertebrae (No. 14167).
2. Turtle: Portion of carapace (No. 13809).

##### AVES (BIRDS) <sup>3</sup>

##### COLYMBIDAE. Grebes

3. **Aechmophorus occidentalis** (Lawrence). Western Grebe.

Humerus (No. 13487).

*Geographical distribution (Recent)*: Southern Saskatchewan and Manitoba south to Lower California and central Mexico.

*Pleistocene distribution*: Oregon, California.

##### CATHARTIDAE. American Vultures

4. **Cathartes aura** (Linnaeus). Turkey Vulture.

Coracoid (No. 13481).

*Geographical distribution (Recent)*: Southern Canada, most of United States and northern Mexico.

*Pleistocene distribution*: Florida, California.

5. **Coragyps atratus** (Meyer). Black Vulture.

Specimen in United States National Museum.

*Geographical distribution (Recent)*: Northern portions of eastern and central United States south to Mexico and Central America.

*Pleistocene distribution*: Florida.

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<sup>3</sup> The specific bird identifications, as already mentioned, were made by Dr. Alexander Wetmore of the Smithsonian Institution, Washington, D.C.

**6. *Gymnogyps californianus* (Shaw).** California Condor.

Metatarsus (No. 13493), also specimen in United States National Museum.

*Geographical distribution (Recent)*: Washington to Lower California. Not reported from Guadalupe Mountain region.

*Pleistocene distribution*: Florida, California.

**ACCIPITRIDAE.** Kites and Hawks**7. *Accipiter cooperi* (Bonaparte).** Cooper's Hawk.

Premaxillary (No. 13484).

*Geographical distribution (Recent)*: Southern Canada to northern Mexico.

*Pleistocene distribution*: California.

**8. *Buteo swainsoni* Bonaparte.** Swainson's Hawk.

Specimen in United States National Museum.

*Geographical distribution (Recent)*: Canada south to southern South America.

*Pleistocene distribution*: California.

**FALCONIDAE.** Caracaras and Falcons**9. *Falco mexicanus* Schlegel.** Prairie Falcon.

Metatarsus (No. 13491), humerus (No. 13488).

*Geographical distribution (Recent)*: Southern Canada, central and western United States south to southern Lower California and southern Mexico.

*Pleistocene distribution*: California.

**10. *Falco sparverius* Linnaeus.** Sparrow Hawk.

Humerus (No. 13486), tibio-tarsus (No. 13485).

*Geographical distribution (Recent)*: Alaska south to Panama.

*Pleistocene distribution*: Florida, California.

**TETRAONIDAE.** Grouse and Ptarmigans**11. *Tympanuchus pallidicinctus* (Ridgway).** Lesser Prairie Chicken.

Specimen in United States National Museum.

*Geographical distribution (Recent)*: Great Plains region of United States.

*Pleistocene distribution*: Oregon.

**PERDICIDAE.** Partridges and Quails**12. *Oreortyx picta* (Douglas).** Mountain Quail.

Specimen in United States National Museum.

*Geographical distribution (Recent)*: Southwestern Washington south to northern California. Not reported from Guadalupe Mountain region.

*Pleistocene distribution*: California.

**MELEAGRIDIDAE.** Turkeys

13. *Meleagris gallopavo* Linnaeus. Turkey.

Metatarsal (No. 13492), metacarpal (No. 13495).

*Geographical distribution (Recent)*: Southern Canada south to central Mexico.

*Pleistocene distribution*: Pennsylvania, Tennessee, Arkansas, Florida.

**GRUIDAE.** Cranes

14. *Grus canadensis* (Linnaeus). Crane.

Premaxillary (No. 13483).

*Geographical distribution (Recent)*: Alaska and Hudson Bay south to Mexico.

*Pleistocene distribution*: California, Florida, Nebraska.

**STRIGIDAE.** Typical Owls

15. *Bubo virginianus* (Gmelin). Horned Owl.

Humerus (No. 13489).

*Geographical distribution (Recent)*: Alaska and Hudson Bay south to Central and South America.

*Pleistocene distribution*: Oregon, California.

16. *Asio flammeus* (Pontoppidan). Short-eared Owl.

Specimen in the United States National Museum.

*Geographical Distribution (Recent)*: Alaska and Greenland south to Central and South America.

*Pleistocene distribution*: California.

**PICIDAE.** Woodpeckers

17. *Colaptes* sp.

Two humeri (Nos. 13490 and 13494).

*Geographical distribution (Recent)*: Canada south to Lower California and Mexico.

*Pleistocene distribution*: California.

**ICTERIDAE.** Meadowlarks, Blackbirds and Troupials

18. *Xanthocephalus xanthocephalus* (Bonaparte). Yellow-headed Blackbird.

Specimen in the United States National Museum.

*Geographical distribution (Recent)*: Northern Canada South to Mexico.

*Pleistocene distribution*: ?

**FRINGILLIDAE.** Grosbeaks, Finches, Sparrows and Buntings

19. *Loxia curvirostra* Linnaeus. Crossbill.

Premaxillary (No. 13482).

*Geographical distribution (Recent)*: Alaska south to Mexico.

*Pleistocene distribution*: ?

## MAMMALIA (MAMMALS)

## LEPORIDAE. Hares and Rabbits

20. *Lepus townsendii* Bachman. White-tailed Jack Rabbit.

Right ramus without teeth (No. 14008), portion of left maxillary with zygomatic arch (No. 14010).

*Remarks:* Compares favorably with *L. t. campanius* Hollister, the White-tailed Jack Rabbit now living in northern New Mexico. Differs from *L. californicus texianus* Waterhouse, the Texas Black-tailed Jack Rabbit of the Guadalupe Mountain region.

*Geographical distribution (Recent):* North-central New Mexico and northern Arizona north and west to Canada. Not reported from Guadalupe Mountain region.

*Pleistocene distribution:* Oregon.

21. *Lepus alleni* Mearns, referred. Antelope Jack Rabbit.

Anterior portion of a very large ramus (No. 14009).

*Remarks:* Heavier than any of the *L. alleni* material examined. In proportions more like the northern *L. arcticus* Ross, but a larger collection of *alleni* material may show that there are heavier forms. Closely related to *L. giganteus* Brown from the middle Pleistocene of Arkansas and Nebraska.

*Geographical distribution (Recent):* Arizona. Not reported from New Mexico.

*Pleistocene distribution:* ?

22. *Sylvilagus floridanus* (Allen), referred. Large Cottontail.

Portion of skull with left and right alveoli P 2/-M 3/ (No. 13444), portion of skull with right alveolar series (No. 14011), left ramus without teeth (No. 14015), ramus with premolar 3 (No. 14012).

*Remarks:* A large form comparing favorably with *S. f. holzneri* (Mearns) and *S. f. cognatus* (Nelson).

*Geographical distribution (Recent):* *S. f. holzneri* found in the higher mountain ranges of extreme southern Arizona, southwestern New Mexico and Mexico. *S. f. cognatus* found in high mountain summits and adjacent slopes of central and west-central New Mexico. Neither form reported from the Guadalupe Mountains.

*Pleistocene distribution:* Arkansas, Florida, Illinois, Iowa, Maryland, Nebraska, Pennsylvania, South Carolina, Virginia.

23. *Sylvilagus auduboni* (Baird), referred. New Mexico Cottontail.

Portion of left side of skull with alveoli (No. 14014).

*Remarks:* Much smaller than the material referred to *Sylvilagus floridanus*. Not distinguishable from *S. a. neomexicanus* now living in the Gua-

daloupe Mountain region. However, it is impossible to definitely identify such incomplete material.

*Geographical distribution (Recent)*: Montana and southwestern North Dakota south into Mexico, Texas west to California.

*Pleistocene distribution*: California.

#### SCIURIDAE. Squirrels

24. *Marmota flaviventris* (Audubon and Bachman). Marmot. Plate 16, figs. 5-8.

Six rami (Nos. 14080-14085), ramus with complete dentition (No. 13587); ramus (No. 14112), incisor (No. 14016), fragment of skull (No. 14146).

*Remarks*: Compares very favorably with *M. f. obscura* Howell from north-central New Mexico.

*Geographical distribution (Recent)*: Northern New Mexico north and west into Canada. Not reported from southern New Mexico. Dr. Vernon Bailey (1931, p. 131), in reporting on the distribution and habitat of *M. f. obscura*, writes:

"Dusky marmots are common in the higher mountains of northern New Mexico and southern Colorado, mainly in the Hudsonian Zone. There are specimens from Pecos Baldy, Truchas Peak, Wheeler Peak, and Agua Fria Peak. In the Pecos River Mountains in August, 1903, they were common from a little below timber line at 11,400 feet to the highest peaks in that range or throughout the Hudsonian and even into Arctic-Alpine Zone. On the top of Truchas Peak at 13,300 feet one had dug a burrow under the triangulation monument, and whistled at observers from the rocks only a little below. In the Taos Mountains in August of the following year marmots were also abundant throughout the Hudsonian Zone from 11,000 feet up to extreme timber line, and a few old signs were seen on the very top of Wheeler Peak at 13,600 feet. Apparently no woodchucks are known in the low country of New Mexico."

*Pleistocene distribution*: California, Washington.

25. *Cynomys ludovicianus* (Ord). Prairie dog.

Right ramus with P 4-M 1 (No. 14023).

*Remarks*: Same as *C. l. arizonensis* Mearns now living in the Guadalupe Mountain region.

*Geographical distribution (Recent)*: Montana and North Dakota south to Texas and Mexico.

*Pleistocene distribution*: Nebraska.

26. *Otospermophilus grammurus* (Say). Rock Squirrel.

Skull with left and right P 2/-M 3/ (No. 13588), left ramus with complete dentition (No. 14022), left ramus with M 1-3 (No. 14021), palate with left and right P 2/-M 3/ (No. 14020), upper portion of skull (No. 14147).

*Remarks:* Same characters and size as *O. grammurus* from Utah and Colorado. Compares closely with *O. g. douglasi* (Richardson) known from Potter Creek and Samwel caves in California.

*Geographical distribution (Recent):* Eastern Colorado south into western Texas, New Mexico west to California. Reported from Gaudalupe Mountains.

*Pleistocene distribution:* California.

#### GEOMYIDAE. Pocket Gophers

27. **Thomomys fulvus pervagus** Merriam, referred. Western Pocket Gopher.

Four rami (Nos. 14074, 14077, 14078 and 14013).

*Remarks:* Larger than typical *T. f. fulvus* (Woodhouse) from the Guadalupe Mountain region. Equal to the average *T. f. pervagus*.

*Geographical distribution (Recent):* North-central New Mexico, southern Colorado.

*Pleistocene distribution:* ?

28. **Thomomys fulvus intermedius** Mearns, referred. Intermediate Pocket Gopher.

Three rami (Nos. 14075, 14076 and 14079), anterior portion of skull with left incisor and alveoli for molars (No. 14073).

*Remarks:* A small form equal to *T. f. intermedius*.

*Geographical distribution (Recent):* "On the tops of numerous mountain ranges in southeastern Arizona and southwestern New Mexico" (Bailey, 1931, p. 237). Not reported from Guadalupe Mountain region.

*Pleistocene distribution:* ?

29. **Cratogeomys castanops** (Baird). Chestnut Pocket Gopher.

Right ramus without teeth (No. 14088), anterior portion of skull with alveoli of incisors and molars (No. 14091), anterior portion of skull with right incisor and alveoli for molars (No. 14087), palate with alveoli (No. 14092), incisor (No. 14090).

*Remarks:* Not distinct from *C. castanops* now living in Guadalupe Mountain region.

*Geographical distribution (Recent):* Southeastern Colorado, eastern New Mexico, western Oklahoma south through Texas into Mexico.

*Pleistocene distribution:* ? Arizona.

30. **Pappogeomys?** sp. Pocket Gopher.

Right ramus with incisor only (No. 14089).

*Remarks:* Very close to the nearby Mexican species, *P. bulleri* (Thomas). When more complete material is found this form may prove to be a small variety of *Cratogeomys*.

*Geographical distribution (Recent):* Central Mexico. Not reported from the Guadalupe Mountain region.

*Pleistocene distribution:* ?



**HETEROMYIDAE.** Pocket Rats and Pocket Mice**31. *Perodipus montanus richardsoni*** (Allen), referred. Kangaroo Rat.

Anterior portion of skull with P 4/ (No. 14119), anterior portion of skull with incisors and right P 4/ (No. 14118).

*Remarks:* Compares favorably with *P. m. richardsoni* of eastern New Mexico.

*Geographical distribution (Recent):* Oklahoma, western Texas, eastern edge of New Mexico, Colorado, northeastern Utah, Wyoming. Not reported from Guadalupe Mountains.

*Pleistocene distribution:* ?

**MURIDAE.** Rats and Mice**32. *Peromyscus maniculatus*** (Wagner), referred. Deer Mouse.

Right ramus with incisor and M/1 (No. 14114).

*Remarks:* Same characters and size as *P. m. blandus* Osgood now living below the mountain forests in southern New Mexico but not distinct from the smaller specimens of *P. m. rufinus* (Merriam) from northern New Mexico.

*Geographical distribution (Recent):* Alaska, central and western Canada, western one-half of United States south into Mexico. Not reported from Guadalupe Mountains but known from surrounding territory.

*Pleistocene distribution:* California, Pennsylvania.

**33. *Neotoma cinerea orolestes*** Merriam, referred. Colorado Wood Rat.

Right ramus with incisor and M/1 (No. 14093), right ramus with incisor and M/1-2 (No. 14102), left ramus with incisor only (No. 14104), right ramus with M/2-3 (No. 14105), right ramus with incisor only (No. 14107), right ramus with no teeth (No. 14108), right ramus with M/1-3 (No. 14094), right ramus with incisor only (No. 14106), right ramus with incisor and M/1 (No. 14098), right ramus with no teeth (No. 14103), right ramus with no teeth (No. 14110), anterior portion of skull with left and right M 1-3/ (No. 14086), left maxillary with M 1-2/ (No. 14111), right maxillary with M 1/ and M 3/ (No. 14100).

*Remarks:* A large form comparing favorably with *N. c. orolestes* from the high mountain ranges of north-central New Mexico.

*Geographical distribution (Recent):* Southern Montana, North Dakota, South Dakota, Wyoming, Colorado and north-central New Mexico. Not reported from Guadalupe Mountain region.

*Pleistocene distribution:* ? California.

**34. *Neotoma mexicana*** Baird, referred. Mexican Wood Rat.

Right ramus with incisor and M/3 (No. 14095), right ramus with incisor and M/1 (No. 14096), left ramus with incisor only (No. 14099).

*Remarks:* Not distinct from *N. m. mexicana* now living in the Guadalupe Mountain region. Much smaller than the *N. cinerea orolestes* Merriam material from the cave.

*Geographical distribution (Recent):* Mountains in western Texas, southwestern New Mexico, southeastern Arizona, Mexico.

*Pleistocene distribution:* ?

35. **Neotoma lepida** Thomas, referred. Small Wood Rat.

Left ramus with M /1-2 (No. 14101), right ramus with M /1 and M /3 (No. 14097).

*Remarks:* A very small form comparable to *N. lepida* from western New Mexico.

*Geographical distribution (Recent):* Eastern Arizona, western New Mexico. Not reported from the Guadalupe Mountain region.

*Pleistocene distribution:* ?

36. **Microtus mordax** (Merriam), referred. Rocky Mountain Meadow Mouse.

Anterior portion of skull with incisors and alveoli of molars (No. 14113), left ramus with incisor and alveoli of molars (No. 13448 A), right ramus with incisor and M /1 (No. 13448 B).

*Remarks:* Compares favorably with *M. m. mordax* from central and northern New Mexico.

*Geographical distribution (Recent):* Northern New Mexico to Canada west to Pacific coast. Not reported from Guadalupe Mountains.

*Pleistocene distribution:* California.

37. **Microtus mexicanus guadalupensis** Bailey. Guadalupe Meadow Mouse.

Left ramus with incisor (No. 14117), left ramus with incisor and M/1-2 (No. 14116), ramus without teeth (No. 14115).

*Remarks:* Rami short and robust. Equal to typical *M. m. guadalupensis* now living in Guadalupe Mountains.

*Geographical distribution (Recent):* Southeastern New Mexico, western Texas.

*Pleistocene distribution:* ?

**URSIDAE.** Bears

38. **Arctodus** (or **Arctotherium**) sp., referred. Giant Pleistocene Bear. Plate 16, figs. 1-4.

Three lumbar and one dorsal vertebrae (Nos. 13558, 13601, 14070 and 13403 respectively).

*Remarks:* These specimens are much larger than the corresponding vertebrae of any of the living grizzly bears and are also larger than *Ursus dalli* Merriam, the Alaskan Brown Bear. They are approximately as large as those of *U. middendorffi* Merriam, the Kodiak Bear, and *U. gyas* (Merriam), the Peninsula Giant Bear.

*Geographical distribution (Recent)*: Extinct.

*Pleistocene distribution*: California, Florida, Nebraska, Pennsylvania, Alaska.

#### BASSARISCIDAE. Cacomistles

39. *Bassariscus astutus flavus* Rhoads, referred. Cacomistle or Ringtail.

Right ramus (No. 14000), right P 4/ (No. 14001).

*Remarks*: Not distinct from *B. a. flavus* now living in Guadalupe Mountain region.

*Geographical distribution (Recent)*: Southern United States, from Louisiana to Arizona, south to Mexico.

*Pleistocene distribution*: ? Pennsylvania.

#### MUSTELIDAE. Weasels, Martens, Skunks and Badgers

40. *Mustela nigripes* (Audubon and Bachman). Black-footed Ferret.

Portion of maxilla with right P 3-4/ (No. 13998).

*Remarks*: A very large weasel.

*Geographical distribution (Recent)*: Great Plains, east of Rocky Mountains, from western North Dakota and northern Montana to New Mexico and Texas. Not reported from Guadalupe Mountains.

*Pleistocene distribution*: ?

41. *Conepatus mesoleucus mearnsi* Merriam, referred. Hog-nosed Skunk.

Left ramus (No. 13999).

*Remarks*: Compares favorably with *C. m. mearnsi* now living in Guadalupe Mountain region.

*Geographical distribution (Recent)*: Western Texas, southern New Mexico, Arizona, Mexico.

*Pleistocene distribution*: ?

42. *Taxidea taxus taxus* (Schreber). Badger.

Essentially complete skull without teeth (No. 13457).

*Remarks*: Specimen larger and bullae more inflated than *T. t. berlandieri* Baird, the badger now living in New Mexico and Texas. Compares favorably with the largest *T. t. taxus*, the northern badger, which ranges from Kansas and Colorado north into Canada. More robust than *T. marylandica* Gidley and Gazin from the Pleistocene of Maryland. The only extinct species of *Taxidea* known from southwestern United States is *T. robusta* Hay. This latter species was founded upon an incomplete ulna from the "Early Pleistocene" of the Coconino Plateau, Arizona. The author (Hay, 1921) in describing the new species based his conclusions upon the fact that the incomplete ulna in question was stouter than the corresponding bone of *T. taxus*. With so little information available concerning this larger badger, it is hardly safe to refer the large skull from Burnet Cave to this extinct form.

*Geographical distribution (Recent)*: Central North America from southern Canada south to Colorado.

*Pleistocene distribution*: Kansas, Nebraska, Pennsylvania, Washington.

**CANIDAE.** Wolves, Coyotes and Foxes

43. **Vulpes macroura** Baird, referred. Western Red Fox or Cross Fox.

Rear one-half of skull (No. 13456), left M 1/ (No. 14004), left ramus without teeth (No. 13560), right ramus without teeth (No. 14003).

*Remarks*: *V. macroura* is closely related to *V. fulva* (Desmarest) and material referred to this latter species from the Pleistocene of Arkansas seems to be almost indistinguishable from the Burnet Cave specimens.

*Geographical distribution (Recent)*: Mountains in Wyoming, Utah, Colorado, northern New Mexico. Not reported from Guadalupe Mountain region.

*Pleistocene distribution*: ?

44. **Vulpes velox** (Say). Kit Fox.

Left ramus (No. 14002).

*Remarks*: A small form comparing favorably with *V. velox* and differing from *V. macrotis neomexicana* Merriam, the New Mexico desert fox.

*Geographical distribution (Recent)*: Northern Texas and New Mexico north to Canada. Not reported from Guadalupe Mountain Region.

*Pleistocene distribution*: ?

45. **Canis latrans lestes** Merriam. Rocky Mountain Coyote.

Three rami (Nos. 13455, 13561 and 13589), canine (No. 13997), right P 4/ (No. 13454).

*Remarks*: A very large coyote.

*Geographical distribution (Recent)*: Mountain ranges from northern New Mexico to Canada. Not reported from Guadalupe Mountain region.

*Pleistocene distribution*: ? Oregon.

46. **Canis microdon** Merriam. Small-toothed Coyote.

Ramus (No. 13583).

*Remarks*: Molars unusually small.

*Geographical distribution (Recent)*: Northeastern Mexico and Texas. Not reported from Guadalupe Mountain region.

*Pleistocene distribution*: ?

47. **Canis nubilus** Say, referred. Buffalo Wolf or Lobo.

Left ramus without teeth (No. 14005).

*Remarks*: Reference made to *C. nubilus*, the southern form, although indistinguishable from *C. occidentalis* (Richardson), the northern form.

*Geographical distribution (Recent)*: Plains area from New Mexico to Canada. Reported from Guadalupe Mountain region.

*Pleistocene distribution*: Arkansas, Illinois, Kansas, Nebraska, Oklahoma, Oregon.

#### FELIDAE. Cats

48. *Felis concolor hippolestes* (Merriam), referred. Rocky Mountain Cougar.

Two incomplete metapodials (Nos. 14006, 14007), distal portion of fibula (No. 13576).

*Remarks*: Larger than *F. c. aztecus* Merriam, the form now living in southern New Mexico. *F. c. hippolestes* is the largest of all living mountain lions.

*Geographical distribution (Recent)*: From North Dakota, Montana and Idaho south through Colorado and Utah to northern New Mexico. Not reported from Guadalupe Mountain region.

*Pleistocene distribution*: California, Oregon, Mexico.

49. *Lynx rufus* (Schreber). Bobcat.

Right ramus with P/3-M/1 (No. 13590), left ramus with M/1 (No. 13575).

*Remarks*: Rami represent two individuals, which are as large as the largest *L. r. baileyi*, the form now living in the Guadalupe Mountain region. However, the Burnett Cave specimens are indistinguishable from the average of the larger mountain wild cat, *L. r. uinta* Merriam, from the higher mountains of northern and central New Mexico. The length from the anterior end of P/3 to the posterior end of M/1 is 28.8 mm. for No. 13590 and 29.5 mm. for No. 13575. This measurement, as well as the other measurements of the rami, compares favorably with *L. r. fischeri* Merriam, of the Rancho La Brea Pleistocene. (Merriam and Stock, 1932, pp. 216-218, tables 112-114).

*Geographical distribution (Recent)*: Main to Georgia, west to California.

*Pleistocene distribution*: Arkansas, California, Florida.

#### EQUIDAE. Horses

50. *Equus excelsus* Leidy. Large Extinct Horse. Plate 15, figs. 1, 6-8.

Posterior portion of skull (No. 13864), right P3/-M3/ (No. 13405), premaxillary with six incisors (No. 13860), immature ramus (No. 13861), crushed ramus from hearth (No. 13374), incomplete ramus (No. 13517), ramus (No. 13858), ramus with P/2-4 (No. 13518), fragment of ramus with M/1-3 (No. 13859), fragment of ramus with P/2-4 (No. 13392), approximately one hundred miscellaneous teeth, four metatarsals (Nos. 13500, 13502, 13811, 13812), two metacarpals (Nos. 13386, 13499), eight distal ends of metatarsals and metacarpals, astragalus (No. 14163), two distal ends of tibiae (Nos. 13506, 13937), proximal end of femur (No. 13380), two distal ends of radii (Nos. 13498, 13388), distal end of humerus (No. 13387), also miscellaneous vertebrae, limb bones, calcanea, astragali, phalanges.

*Remarks:* A large horse, equal to the largest specimens of *E. excelsus*. The remains of this species were by far the most common of the large mammals found in Burnet Cave.

*Geographical distribution (Recent):* Extinct.

*Pleistocene distribution:* Iowa, Kansas, Nebraska, Oklahoma, Texas, Mexico.

51. *Equus tau* Owen, referred. Small Extinct Horse. Plate 15, figs. 2-5.

Left M 2/ (No. 14164), left M 3/ (No. 13547), nine miscellaneous molars and premolars, metacarpals (Nos. 13385, 13813), metatarsals (Nos. 13377, 13513, 13814), proximal end of metacarpal with splints (No. 13504), proximal end of metacarpal (No. 13825), six metatarsal and metacarpal fragments, two distal ends of humeri (Nos. 13516, 13940), radius (No. 13934), tibia (No. 13379), four first phalanges (No. 13407, 13510, 13605, 13822), two second phalanges (No. 13844, 13852), also miscellaneous astragali, calcanea, phalanges, limb bones, vertebrae, etc.

*Remarks:* A very small horse, referable to Owen's fragmentary type (maxillary) of *E. tau* from the Pleistocene of Mexico. Also near to the closely related form, *E. francisci* Hay, from the Pleistocene of Texas. The latter species may prove to be a variety of *E. tau*. Although the teeth correspond very well to both of the above forms, the metapodials are somewhat larger than the type of *E. francisci*. The metpodials of *E. tau* are not known. The Burnet Cave material represents at least four individuals.

*Geographical distribution (Recent):* Extinct.

*Pleistocene distribution:* Mexico, Texas, Florida.

#### CAMELIDAE. Camels

52. *Camelops* sp. Large Extinct Camel. Plate 11, fig. 3.

Axis vertebrae (No. 14071).

*Remarks:* About the size of *C. kansanus* Leidy.

*Geographical distribution (Recent):* Extinct.

*Pleistocene distribution:* California, Colorado, Idaho, Iowa, Kansas, Nebraska, Oklahoma, Oregon, Texas.

#### CERVIDAE. Deer

53. *Odocoileus virginianus* (Boddaert). Virginia Deer. Plate 14, fig. 6.

Metatarsal (No. 13910), right ramus with P /2-4 (No. 13914), fragment of maxillary with two molars (No. 13913), fragment of maxillary with M 2-3/ (No. 13915), fragment of maxillary with two molars (No. 13919), fragment of maxillary with two molars (No. 13911), fragment of molar (No. 13916).

*Remarks:* Not distinct from *O. v. macrourus* (Rafinesque), the Plains White-tailed Deer, now living in the Guadalupe Mountain region.

*Geographical distribution (Recent):* Eastern Canada and United States west to Rocky Mountains.

*Pleistocene distribution*: Florida, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Michigan, Mississippi, Missouri, Nebraska, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, Wisconsin.

54. *Odocoileus hemionus* (Rafinesque). Black-tailed or Mule Deer.

Left antler (No. 13556), prong of antler (No. 13586), three miscellaneous teeth, last lower molar (No. 13932), skull fragment with bases of antlers (No. 13555).

*Remarks*: A large form. No. 13932 is suggestive of *Rangifer* but probably belongs to a large *Odocoileus*.

*Geographical distribution (Recent)*: Western North America. Reported Guadalupe Mountain region.

*Pleistocene distribution*: Arkansas, Pennsylvania, Mexico.

55. *Sangamona?* sp. Extinct Cervid. Plate 14, fig. 9.

Metapodial (No. 13931), humerus (No. 13930), right maxillary with P 3-4/ (No. 13592), right maxillary with P 3/-M 1/ (No. 13591), left maxillary with P 2-4/ (No. 13578), right upper molar (No. 14065), left upper molar (No. 13582), right immature ramus (No. 13579), right ramus (No. 14060).

*Remarks*: Size intermediate between *Odocoileus* and *Cervus*. Probably equal to *Sangamona* (Hay, 1920, p. 91).

*Geographical distribution (Recent)*: Extinct.

*Pleistocene distribution*: Illinois, Maryland, Tennessee.

56. *Rangifer?* *fricki*, new species. Caribou-like Cervid. Plate 13, figs. 1-2; Plate 14, fig. 7.

*Type material*: Right maxillary fragment with dentition and right ramus (No. 13594).

*Referred specimen*: Proximal end of metatarsal (No. 13933).

*Description and measurements*:

MEASUREMENTS OF RAMUS

	mm.
Length of ramus (posterior of condyle to posterior of alveolus of incisor 1)...	285.
Depth of ramus below anterior end of P/2.....	33.
Depth of ramus below posterior end of M/3.....	38.
Length of molar-premolar series (P/2-M/3).....	105.5
P/2-P/4, length.....	43.5
M/-M/3, length.....	63.
P/2, greatest anteroposterior diameter (on triturating surface).....	12.5
greatest transverse diameter.....	8.
P/3, greatest anteroposterior diameter.....	15.5
greatest transverse diameter.....	10.
P/4, greatest anteroposterior diameter.....	18.
greatest transverse diameter.....	13.
M/1, greatest anteroposterior diameter.....	18.5
greatest transverse diameter.....	14.

M /2, greatest anteroposterior diameter.....	20.
greatest transverse diameter.....	16.
M /3, greatest anteroposterior diameter.....	16.
greatest transverse diameter.....	14.5
Length diastema between P /2 and I /3.....	91.

## MEASUREMENTS OF UPPER DENTITION

P 3/, greatest anteroposterior diameter (on triturating surface) .....	16.
greatest transverse diameter.....	16.
P 4/, greatest anteroposterior diameter.....	14.5
greatest transverse diameter.....	15.5
M 1/, greatest anteroposterior diameter.....	17.
greatest transverse diameter.....	18.5
M 2/, greatest anteroposterior diameter.....	21.
greatest transverse diameter.....	18.
M 3/, greatest transverse diameter.....	17.5

The Burnet Cave maxillary fragment and ramus (Plate 13, figs. 1-2) belong to one individual. The teeth are well worn. While differing from any of the living and extinct caribou, this material is referred to the genus *Rangifer* because of the relatively great size of the premolars and the long diastema between the premolars and incisors. The metatarsal (Plate 14, fig. 7) is caribou-like. More material and further study may prove this to belong to a new genus. In size, the cave specimens most nearly approach *R. osborni* Allen and *R. montanus* Seton-Thompson, two closely related species of the Mountain caribou. These forms are among the largest of the living caribou. *R. montanus* ranges from northern Wyoming north to meet the range of *R. osborni* in southern Canada. The premolars of *R. muscatinensis* Leidy, the Pleistocene caribou from Iowa, measure 48 mm., while the molars measure 56 mm. It is evident that the premolars are proportionately larger in this form than in *R. ? fricki*.

The new species is named in honor of Mr. Childs Frick of the American Museum of Natural History.

*Geographical distribution (Recent):* Extinct.

*Pleistocene distribution:* ?

## ANTILOCAPRIDAE. Pronghorn

57. *Tetrameryx onusrosagris* Roosevelt and Burden. Four-horned Antelope. Plate 11, fig. 1; Plate 14, fig. 5.

Portion of right side of skull with orbit and horn-cores (No. 14033), right ramus with molar 3 present (No. 14032), five upper teeth (Nos. 14035-8 and No. 13606), four astragali (Nos. 14044, 14045, 13451, 14050), distal end of tibia (No. 13565 A), two proximal ends of tibiae (Nos. 14042, 14043), distal end of radius (No. 13565 B), proximal end of metacarpal (No. 14041), three first phalanges (Nos. 14047, 14049, 14053), half of pelvis (No. 14039), metatarsal (No. 14040).

*Remarks:* Some of the above skeletal parts may belong to *Antilocapra americana* (Ord). A comparison of the type material of *T. onusrosagris*



with typical *A. americana* shows a very close relationship between these two forms and many of the skeletal parts are almost indistinguishable. The horn-cores (No. 14033) and ramus (No. 14032) from Burnet Cave compare favorably with *T. onusrosagris*, as is shown by the following comparative measurements:

	Burnet Cave specimen (No. 14033)	<i>Tetrameryx onusrosagris</i> , Type material in Am. Mus. Nat. Hist.							<i>Tetrameryx schuleri</i> , Type (No. 150) in Southern Methodist University.
		A. M. 22488	A. M. 22489	A. M. 22484A	A. M. 22484B	A. M. 22484C	A. M. 22484D	A. M. 22484E	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Anteroposterior diameter of base of horn.	52.5	60.0	57.0	51.5	58.0	59.0	.....	.....	65.0
Diameter at right angles .....	21.5	23.0	26.0	21.0	24.5	24.5	.....	.....	25.0
Distance between horn cores at 20 mm. above crotch .....	19.0	27.0	24.0	23.0	.....	26.0	.....	.....	23.0
Anteroposterior diameter of anterior core at 20 mm. above crotch .....	25.0	29.5	30.0	27.5	.....	28.0	27.5	26.0	23.5
Transverse diameter of anterior core at 20 mm. above crotch .....	21.5	23.0	22.5	19.5	20.	21.	30.5	20.5	20.0
Anteroposterior diameter of posterior core at 20 mm. above crotch .....	23.0	29.0	30.5	26.5	28.0	30.0	.....	.....	30.0
Transverse diameter of posterior core at 20 mm. above crotch .....	19.5	22.0	23.0	18.5	21.0	22.0	.. .	.....	19.5

Length of molar-premolar series in ramus A.M. 22490

(type material of *T. onusrosagris* in Amer. Nat. Hist. .... 65 mm.

Length of molar-premolar series in ramus No. 14032

(Burnet Cave specimen) ..... 66 mm.

The cave specimen differs from *T. schuleri* Lull in that the horn-cores are nearly equal in length. *T. conklingi* Stock is a much smaller form.

*Geographical distribution (Recent):* Extinct.

*Pleistocene distribution:* Arizona.

### 58. *Antilocapra americana* (Ord), referred. Pronghorn Antelope.

Left ramus with base of M /1-3 (No. 13913).

*Remarks:* Ramus very robust. Alveoli indicate that anterior molars and premolars were much larger than the corresponding ones of *Tetrameryx*

*onusrosagris*. The *T. onusrosagris* rami are much more slender with no noticeable angles along the horizontal ramus as in *Antilocapra* specimens. It must be noted that the smallest examples of *Antilocapra* are very nearly the size of *Tetrameryx*. The ramus (No. 13913) was compared with a typical *A. americana* ramus which possessed teeth in the same stage of wear. Since there was no marked difference in the two rami and since the cave specimen did not compare with any known *Tetrameryx*, it is therefore referred to *Antilocapra*.

MEASUREMENTS COMPARING *Antilocapra* AND *Tetrameryx*

	<i>Tetrameryx</i> <i>onusrosagris</i> ramus (No. 14032) from Burnet Cave	<i>Tetrameryx</i> <i>onusrosagris</i> ramus (No. 22490) in type collection in American Museum	<i>Antilocapra</i> <i>americana</i> ramus (No. 13913) from Burnet Cave	<i>Antilocapra</i> <i>americana</i> ramus (Recent)	<i>Antilocapra</i> <i>americana</i> ramus (Recent)
	mm.	mm.	mm.	mm.	mm.
Anterior width of alveolus of M /3.....	7.	7.	7.	7.	8.
Posterior width of alveolus of M /2.....	6.2	6.5	6.8	7.	7.
Posterior width of alveolus of M /1.....	5.	5.	6.8	6.8	6.8
Posterior width of alveolus of P /4.....	3.6	4.	5.5	5.5	5.6

*Geographical distribution (Recent)*: Northern Mexico, western United States, southwestern Canada.

*Pleistocene distribution*: California, Illinois, Iowa, Nebraska, Oregon.

#### BOVIDAE. Bison, Muskoxen and Mountain Sheep

59. *Euceratherium collinum morrissi*, new variety. Extinct Muskox-like Bovid.  
Plate 13, figs. 3-4; Plate 14, figs. 1-4, 10.

Posterior portion of skull with horn-cores (No. 13418).

Specimens doubtfully referred to *Euceratherium*: Palate with right M 1-3/ and left M 2-3/ (No. 13808), left ramus with P /3-M /3, and right ramus with P /4-M /3 (No. 13806), metacarpal (No. 13950), astragalus (No. 13982), first phalanx (No. 13423), second phalanx (No. 13438).

*Remarks and description*: *E. c. morrissi* is from twenty to thirty per cent larger than the type of *E. collinum*. The horn-cores of the new variety are more erect in their position than *E. collinum*. A comparison of

some of the important measurements of *E. collinum* and *E. c. morrisi* are given below:

	<i>E. collinum</i> . Type. University California No. 8751	<i>E. collinum</i> <i>morrisi</i> Type. Burnet Cave No. 13418
	mm.	mm.
Maximum length of horn-core, along outer curve.....	...	585.
Width across bases of horn-cores.....	112.	138.
Anteroposterior diameter of horn-core at base.....	76.	92.5
Transverse diameter of horn-core at base.....	43.	61.
Circumference of horn-core at base.....	....	245.
Anterior base of horn-core to the tip.....	....	285.

*E. c. morrisi* resembles a horn-core (No. 2337) in the University of California paleontological collections. This horn-core was collected from the gravels of the Klamath River, California, and was referred to the genus *Euceratherium* (Stock and Furlong, 1927, pp. 412-413, fig. 1).

The new variety is named in honor of Mr. Effingham B. Morris, President of The Academy of Natural Sciences of Philadelphia.

*Geographical distribution (Recent)*: Extinct.

*Pleistocene distribution*: California.

60. *Preptoceras sinclairi neomexicana*, new variety. Extinct Muskox-like Bovid.

Plate 12, figs. 2-3.

*Type specimen*: Left horn-core (No. 13807).

*Remarks and description*:

#### MEASUREMENTS OF HORN-CORES OF *Preptoceras*

	<i>Preptoceras</i> <i>sinclairi</i> . Type. (No. 8896) Uni. of Calif.	<i>Preptoceras</i> <i>sinclairi</i> , referred. (No. 27118) Uni. of Calif.	<i>Preptoceras</i> <i>mayfieldi</i> . Type. (No. 10920) Yale Museum	<i>Preptoceras</i> <i>sinclairi</i> <i>neomexicana</i> . Type. (No. 13807) Burnet Cave
	mm.	mm.	mm.	mm.
Maximum length of horn-core along outer curve....	....	....	....	430.
Greatest diameter of horn-core at base.....	96.	96.8	85.	90.
Transverse diameter of horn-core at base.....	77.	76.7	74.	61.
Circumference of horn-core at base.....	....	....	....	235.
Anterior base of horn-core to the tip.....	....	....	....	240.

The base of the horn-core of *P. mayfieldi* Troxell is nearly round and the transverse diameter is 87 per cent of the maximum diameter. In *P. sinclairi* the transverse diameter is approximately 80 per cent of the maximum diameter. The base of *P. s. neomexicana*, the new variety, is much more flattened than in either of the other forms. The transverse diameter of the Burnet Cave specimen is only 67 per cent of the maximum diameter. As is noted in Plate 12, fig. 3, the upper surface of the base of the horn-core of *P. s. neomexicana* has deep grooves running parallel to the length of the horn.

This horn-core is interesting because it was found in a hearth four feet below the deepest Basket Maker burial in direct association with the Folsom-like point figured on Plate 11. The horn-core was first thought to have belonged to *Boötherium*, a Pleistocene muskox from northern United States and Alaska (Howard, 1932).

*Geographical distribution (Recent)*: Extinct.

*Pleistocene distribution*: ?

61. *Bison antiquus taylori* (Hay and Cook), referred. Large Extinct Bison. Plate 14, fig. 11.

Tibia (No. 14030), two distal ends of humeri (No. 13414 A and B), distal end of metacarpal (No. 13557), female horn-core (No. 13941), portion of female horn-core (No. 13942), ten miscellaneous teeth, miscellaneous skeletal parts.

*Remarks*: The cave specimens are quite distinct from *Bison bison*, the living species. They belong to a large, robust form and most nearly approach *B. taylori* from the Folsom Bison Quarry, New Mexico. The bison of North America are in need of complete revision and the validity of many of the species is in question. The writers are tentatively referring *taylori* to the closely related form *B. antiquus*.

*Geographical distribution (Recent)*: Extinct.

*Pleistocene distribution*: Colorado, Kansas, Nebraska, New Mexico, Texas.

62. *Ovis auduboni* Merriam, referred. Bighorn Sheep. Plate 11, fig. 4; Plate 14, fig. 8.

Portion of left ramus with P/2 alveolus, P/3-4, M/2-3 (Nos. 14055, 14056, 14057), right M 1-2/ (No. 13593), right M 3/ (No. 13459), metacarpal (No. 13564), portion of horn-core (No. 14067), distal end of tibia (No. 14054), phalanges (Nos. 13437, 14165).

*Remarks and comparisons*: In the type description (Merriam, 1901), the characters which differentiate *auduboni* from the typical *canadensis* are as follows:

"Size large; skull and horns broad and massive; molar teeth much larger than in any American Sheep, the upper tooth-row in adult males measuring

96 mm. or more, and the 3 upper molars 63-65 mm. Under jaw massive, heavy posteriorly, deeply bellied (depth under last molar 52 mm.); angle broadly rounded. In *canadensis* the jaw is light throughout and the angle while small, is marked."

The specimens from Burnet Cave compare very favorably with this description. In these, the length of the lower dentition measures approximately 104 mm. and the 3 upper molars, 62.5 mm. The portion of horn-core suggests a very massive horn. The molars are essentially the same in size and characters as a specimen of *O. auduboni*, No. 171884 in the United States National Museum. This specimen was collected in northwestern Wyoming.

*O. c. texianus* Bailey, the sheep now living in the Guadalupe Mountains of Texas and New Mexico (Bailey, 1912), resembles *auduboni* in heavy dentition. However, the alveolar length of the lower tooth-row of the type of *O. c. texianus* is 91-92 mm. and of the upper tooth-row 89-90 mm. This form is smaller than the northern species, *O. auduboni*.

*Geographical distribution (Recent)*: Formerly in the "badlands region" along the Missouri and Yellowstone Rivers in eastern Montana, Wyoming, North Dakota, South Dakota and western Nebraska. Probably extinct (Bailey, 1926).

*Pleistocene distribution*: ?

#### HOMINIDAE

63. *Homo sapiens* Linnaeus, referred. Man.

*Remarks*: No skeletal remains of *Homo* were found. However, his presence is assured by the finding of many hearths and a Folsom-like artifact (Plate 11, fig. 2).

#### CONCLUSIONS

Forty-three forms of mammals were found in Burnet Cave. Of these, 23 per cent are extinct, 12 per cent are living but are not found in New Mexico, 30 per cent are now living in the Guadalupe Mountain region, and 35 per cent are living in New Mexico but are not reported from the Guadalupe Mountains.

Thirteen forms of large mammals (artiodactyls and perissodactyls) were identified from the cave. Sixty-eight per cent of these are extinct and 23 per cent are now living in the Guadalupe Mountain region.

It is interesting to note that many of the cave forms, now living in regions other than the Guadalupe Mountains, are found to the north and in many cases in the higher mountains. Several of these species and varieties now live in life-zones as high as the Arctic-Alpine zone. This is a strong indication that the climate in the region of the cave, during the time of the pre-Basket Maker occupation, was much different than it is today.

Dr. A. Wetmore reports that three of the seventeen birds from Burnet Cave are not found in New Mexico today. These three forms are the Black Vulture, the California Condor, and the Mountain Quail.

Much of the material from Burnet Cave is fragmentary and exact identifications were difficult. Additional and more complete material from other caves in southwestern United States and Mexico will undoubtedly necessitate some changes and also add more forms to the list.

Table of Mammals Found in Burnet Cave

	Extinct Living, but not found in N. Mex.	Living in N. Mex. but not Guadalupe Mts.	Living in Guadalupe Mts.
20. <i>Lepus townsendi</i> Bachman. White-tailed Jack Rabbit.....		×	
21. <i>Lepus alleni</i> Mearns, referred. Antelope Jack Rabbit.....	×	×	
22. <i>Sylvilagus floridanus</i> (Allen), referred. Large Cottontail.....		×	
23. <i>Sylvilagus auduboni</i> (Baird), referred. New Mexico Cottontail..			×
24. <i>Marmota flaviventris</i> (Audubon and Bachman). Marmot.....		×	
25. <i>Cynomys ludovicianus</i> (Ord). Prairie dog.....			×
26. <i>Otospermophilus grammurus</i> (Say). Rock Squirrel.....			×
27. <i>Thomomys fulvus pervagus</i> Merriam, referred. Western Pocket Gopher.....		×	
28. <i>Thomomys fulvus intermedius</i> Mearns, referred. Intermediate Pocket Gopher.....		×	
29. <i>Cratogeomys castanops</i> (Baird). Chestnut Pocket Gopher.....			×
30. <i>Pappogeomys?</i> sp. Pocket Gopher.....	×		
31. <i>Perodipus montanus richardsoni</i> (Allen), referred. Kangaroo Rat		×	
32. <i>Peromyscus maniculatus</i> (Wagner), referred. Deer Mouse.....		×	
33. <i>Neotoma cinerea orolestes</i> Merriam, referred. Colorado Wood Rat		×	
34. <i>Neotoma mexicana</i> Baird, referred. Mexican Wood Rat.....			×
35. <i>Neotoma lepida</i> Thomas, referred. Small Wood Rat.....		×	
36. <i>Microtus mordax</i> (Merriam), referred. Rocky Mountain Meadow Mouse.....		×	
37. <i>Microtus mexicanus guadalupensis</i> Bailey. Guadalupe Meadow Mouse.....			×
38. <i>Arctodus</i> (or <i>Arctotherium</i> ) sp., referred. Giant Pleistocene Bear.	×		
39. <i>Bassariscus astutus flavus</i> Rhoads, referred. Cacomistle or Ringtail			×
40. <i>Mustela nigripes</i> (Audubon and Bachman). Black-footed Ferret		×	
41. <i>Conepatus mesoleucus mearnsi</i> Merriam, referred. Hog-nosed Skunk.....			×
42. <i>Taxidea taxus taxus</i> (Schreber). Badger.....	×		
43. <i>Vulpes macroura</i> Baird, referred. Western Red Fox or Cross Fox		×	
44. <i>Vulpes velox</i> (Say). Kit Fox.....		×	
45. <i>Canis latrans lestes</i> Merriam. Rocky Mountain Coyote.....		×	
46. <i>Canis microdon</i> Merriam. Small-toothed Coyote.....	×		
47. <i>Canis nubilus</i> Say, referred. Buffalo Wolf or Lobo.....			×
48. <i>Felis concolor hippolestes</i> (Merriam). Rocky Mountain Cougar.		×	
49. <i>Lynx rufus</i> (Schreber). Bobcat.....			×
50. <i>Equus excelsus</i> Leidy. Large Extinct Horse.....	×		
51. <i>Equus tau</i> Owen, referred. Small Extinct Horse.....	×		
52. <i>Camelops</i> sp. Large Extinct Camel.....	×		

53. <i>Odocoileus virginianus</i> (Boddaert). Virginia Deer.....				×
54. <i>Odocoileus hemionus</i> (Rafinesque). Black-tailed or Mule Deer..				×
55. <i>Sangamon</i> ? sp. Extinct Cervid.....	×			
56. <i>Rangifer</i> ? <i>fricki</i> , new species. Caribou-like Cervid.....	×			
57. <i>Tetrameryx onusosagris</i> Roosevelt and Burden. Four-horned Antelope.....	×			
58. <i>Antilocapra americana</i> (Ord), referred. Pronghorn Antelope....				×
59. <i>Euceratherium collinum morrissi</i> , new variety. Extinct Muskox...	×			
60. <i>Preptoceras sinclairi neomexicana</i> , new variety. Extinct Muskox.	×			
61. <i>Bison antiquus taylori</i> (Hay and Cook), referred. Large Extinct Bison.....	×			
62. <i>Ovis auduboni</i> Merriam, referred. Bighorn Sheep.....		×		

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## EXPLANATION OF PLATES 11-16

## PLATE 11.

Fig. 1, *Tetrameryx onusrosagris*, fragment of skull with horn-core, No. 14033, x  $\frac{1}{2}$ . Fig. 2, Folsom-like artifact found associated with fossil remains listed in this paper, x 1. Fig. 3, *Camelops* sp., axis vertebra, No. 14071, x  $\frac{1}{2}$ . Fig. 4, *Ovis auduboni*, referred, inferior dentition, Nos. 14055, 14056, 14057, x  $\frac{1}{2}$ .

## PLATE 12.

Fig. 1, *Preptoceras sinclairi*, posterior view of the skull of the type for comparison, after Furlong, x  $\frac{1}{2}$  (approx.). Fig. 2, *Preptoceras sinclairi neomexicana*, new variety, posterior view of the left horn-core, No. 13807, x  $\frac{1}{2}$ . Fig. 3, *Preptoceras sinclairi neomexicana*, new variety, lateral view of the left horn-core, No. 13807, x  $\frac{1}{2}$ .

## PLATE 13.

Fig. 1, *Rangifer? fricki*, new species, right superior and inferior dentition, drawn in reverse, No. 13594, x 1. Fig. 2, *Rangifer? fricki*, new species, lateral view of the right ramus, No. 13594, x  $\frac{1}{2}$ . Fig. 3, *Euceratherium collinum morrissi*, new variety, lateral view of the posterior portion of skull, No. 13418, x  $\frac{1}{2}$ . Fig. 4, *Euceratherium collinum morrissi*, new variety, posterior view of the skull, No. 13418.

## PLATE 14.

Fig. 1, *Euceratherium?* sp., palate, No. 13808, x  $\frac{1}{2}$ . Fig. 2, *Euceratherium?* sp., left ramus, with condyle and coronoid of right ramus showing, No. 13806, x  $\frac{1}{2}$ . Fig. 3, *Euceratherium?* sp., crown view of left P<sub>3</sub>-M<sub>3</sub>, No. 13806, x  $\frac{1}{2}$ . Fig. 4, *Euceratherium?* sp., crown view of right M 1-3, No. 13808, x  $\frac{1}{2}$ . Fig. 5, *Tetrameryx onusrosagris*, referred, metatarsal, No. 14040, x 3/11. Fig. 6, *Odocoileus virginianus*, metatarsal, No. 13910, x 3/11. Fig. 7, *Rangifer?* sp., proximal end of metatarsal, No. 13933, x 3/11. Fig. 8, *Ovis auduboni*, referred, distal end of metacarpal, No. 13564, x 3/11. Fig. 9, *Sangamon?* sp., distal end of metatarsal, No. 13931, x 3/11. Fig. 10, *Euceratherium?* sp., metacarpal, No. 13950, x 3/11. Fig. 11, *Bison antiquus taylori*, referred, distal end of metacarpal, No. 13557, x 3/11.

PLATE 15.

Fig. 1, *Equus excelsus*, right P<sup>3</sup>-M<sup>3</sup>, No. 13405, x  $\frac{3}{4}$ . Fig. 2, *Equus tau*, referred, left M<sup>2</sup>, No. 14164, and left M<sup>3</sup>, No. 13547, x  $\frac{3}{4}$ . Fig. 3, *Equus tau*, referred, astragalus, No. 13410, x 11/20. Fig. 4, *Equus tau*, referred, metatarsal, No. 13513, x 11/20. Fig. 5, *Equus tau*, referred, metacarpal, No. 13813, x 11/20. Fig. 6, *Equus excelsus*, astragalus, No. 14163, x 11/20. Fig. 7, *Equus excelsus*, metacarpal, No. 13499, x 11/20. Fig. 8, *Equus excelsus*, metatarsal, No. 13812, x 11/20.

PLATE 16.

Figs. 1-3, *Arctodus* (or *Arctotherium*) sp., referred, lumbar vertebrae, Nos. 13601, 13558, 14070, x 11/20. Fig. 4, *Arctodus* (or *Arctotherium*) sp., referred, dorsal vertebra, No. 13403, x 11/20. Fig. 5, *Marmota flaviventris*, superior view of right ramus, No. 13587, x 11/20. Figs. 6-8, *Marmota flaviventris*, lateral views of right rami, Nos. 14082, 14081, 14080, x  $\frac{5}{7}$ .

## THE OCCURRENCE OF FLINTS AND EXTINCT ANIMALS IN PLUVIAL DEPOSITS NEAR CLOVIS, NEW MEXICO. PART I,—INTRODUCTION

BY EDGAR B. HOWARD.

During the summer of 1932, upon completing some cave excavations in the Guadalupe Mountains of New Mexico for the University Museum, Philadelphia, and the Academy of Natural Sciences of Philadelphia, A. W. Anderson of Clovis brought to my attention some spearpoints that he had found in sand "blow-outs", lying about fifteen miles southwest of Clovis, between that town and Portales. Since the spearpoints were similar to those found at Folsom, New Mexico, a few years before, associated with extinct bison skeletons, it seemed worthwhile to investigate the site.

I must, therefore, acknowledge at the outset my indebtedness to Mr. Anderson for bringing these discoveries to my attention, and for the many other things that he did to help me during the course of the next year. I should also like to acknowledge the many things that George O. Roberts of Clovis did in connection with furthering the work that followed as a result of his and Anderson's interest in the subject. Both of these men helped in a hundred different ways, not the least of which was to give to the University Museum some of the best artifacts they had found there.

In November, 1932, a road construction company, looking for gravel, made a large pit in one of the basin-like depressions between Clovis and Portales, and in the course of their work encountered large quantities of bison bones and some mammoth bones, tusks, and teeth. The result of this information was a hurried trip to Clovis, where these occurrences were verified. The road company had removed great quantities of bones; but they had made it possible to work around the gravel pit along an exposed face that would have been impossible for us to have excavated ourselves. Furthermore, there were, and still are, enormous quantities of bones left in these deposits.

It was, therefore, decided to make a thorough investigation of this region the following summer. Work was accordingly begun early in the spring of 1933. To help in excavating I had J. McGee and R. Whiteman of Clovis, to both of whom is due credit for most of the finds made that summer. At this point I should like to express grateful appreciation of the personal interest of Dr. John C. Merriam in this work—an interest that made possible the generous support of the Carnegie Institution, in turn resulting in bringing Dr. Chester Stock into the work. Dr. Stock sent F. D. Bode, R. W. Wilson, and D. Curry from the California Institute of Tech-

nology to coöperate in the palaeontological studies. Dr. Merriam also made two visits to Clovis, the second time bringing with him Sir Arthur Smith Woodward and Lady Woodward who were attending the International Geological Congress in Washington, together with Dr. V. Van Straelen, Director of the Royal Museum of Natural History of Brussels.

The area covered by our investigations near Clovis lies between that town and Portales, near the boundary between Curry and Roosevelt Counties in Township I South and from Range 34 E. to Range 36 East. Here, running in a general east-south-east direction is a series of shallow dry basins, resembling old lake beds. This region forms part of the "Llano Estacado" or "Staked Plains", a monotonously flat expanse, broken by sand dunes that rise along the edges of this basin-like depression, locally known as Black Water Draw. No water exists in these basins, except in one or two places where springs feed very shallow alkaline lakes near the Texas boundary, and again towards the west in the direction of Melrose.

The evidence seems to point to a time of greater precipitation when these basins contained more or less permanent water, since which time they have dried up altogether. Since this drying-up process many of these basins have undergone erosion by the wind, so that one can find them in different stages of erosion, from those where only the top soils have been removed down to a more or less hard bluish-gray sand, to those where this bluish sand has been broken through and eroded down to the underlying caliche. In this latter case it is usual to find remnants of the bluish sands left as a shelf around the basin and as "erosion islands" scattered through the middle.

Some twenty or more of these basins or old lake beds, or "blow-outs" as locally known, lie on either side of the Portales-Clovis highway, about ten miles from the latter place. Though we explored the region from beyond the Texas line all the way to the Pecos River, our efforts were concentrated largely at the gravel pit and the "lakes" within a few miles of it to the south and east, and to a series of three or four "lakes" on the east side of the highway, to which the name Anderson Lake was given.

We shall, therefore, consider the gravel pits first, since it offered the best chance to study the deposits that are typical of the other basins in which we worked. At the bottom of the section exposed at the pit by the road company is a reddish sandy clay that lies at the water-table level, approximately seventeen feet below the top of the bluish sands. This reddish clay grades into coarse reddish and yellowish gravels containing good-sized pebbles, concretions and large clay balls. Above this are fine yellow sands interchangeable with pink sands at several places around the pit, and interspersed here and there with thin gravel layers, or lines of manganese sands and coated pebbles. Above these yellow sands on the east side of the pit is a caliche-like deposit, while on the west side is a coarser

speckled sand. Next above all the way around the pit are the bluish gray bone-bearing deposits, composed of clay and silty sands, and having three distinct layers, the middle layer being darker than the upper and lower ones.<sup>1</sup>

A mechanical analysis of these bluish sands made by A. W. Postel of the Department of Geology of the University of Pennsylvania showed that all these old lake beds, from which samples of the bluish sands were taken, showed approximately fifty per cent clay and fifty per cent fine sand with silt predominating. The general similarity of these analyses and the occurrence of certain minerals in the heavy mineral separations that were made, indicate that conditions of deposition were probably the same. The grains were subangular, some were frosted, but they appeared to be largely water deposited.

In the matter of diatoms, Dr. Kenneth E. Lohman, of the United States Geological Survey, very kindly made a report that shows all of the species recorded still living; but their geologic range, not being fully known, no accurate age determination is possible. He says, however: "... In view of the fact that all of the species are now living, a late age is indicated, possibly late Pleistocene or early Recent."

Dr. Paul B. Sears, of the University of Oklahoma, found no pollen, except stray grains, in these deposits. Fragments of charcoal from a hearth in the bluish sands were examined by Dr. R. W. Chaney, of the University of California, and from the specimens examined he concludes: "On the basis of these two genera (*Sapindus* and *Sambucus*) the generalization may be made that the climate at Clovis during the time the wood fragments were accumulated was similar to that in the colder, Transition to Boreal Zone localities. Dr. Henry A. Pilsbry in identifying the shells from these deposits states: "The presence of this species (*Lymnaea palustris nuttalliana* Lea) fossil in southeastern New Mexico, in a region near the junction of the upper and lower Austral zones, indicates widely different former climatic conditions from those now prevailing there, and leads to the conclusion that the deposits date from Glacial (Pleistocene) time. The shifting of isotherms through several hundred miles can hardly be interpreted in any other way. The presence of large forms of *Helisoma trivolvis* and *H. anceps* confirms this conclusion. Such forms now occur in colder, Transition to Boreal zone localities. The modern forms of these species in that region are *H. trivolvis lentus* (Say) and a different, smaller, race of *H. anceps*. The occurrence of a *Sphaerium* differing from any species known living in the region, and apparently extinct, is another indication of Pleistocene".

The importance of the bluish sands lies in the fact that, not only at the pit, but in all of the old lake beds investigated, artifacts were found, some

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<sup>1</sup> See plate 17, accompanying part II of the present report.

definitely in place in these deposits, and others weathering out of the exposed surfaces along with bison and mammoth bones.

For lack of space we cannot go into detailed description of the various types of artifacts found here. This has been covered, together with plates giving examples of each type, in the University Museum Journal.<sup>2</sup> It will suffice to give a brief account of the associations. Found actually in place in the blue sands at the pit, and again in Anderson Lake, near the bottom of these same sands, were small flake knife-like implements and one snub-nosed scraper. These were found in direct association with bison bones, and with bird and small mammal bones, some of which were burned. In Anderson Lake, just above the top of the caliche, was a lens of charcoal from which these flake knives and scrapers were removed by Dr. Merriam in the presence of Sir Arthur Smith Woodward and Lady Woodward, Dr. Van Straelen, Dr. Chester Stock, and a number of others.

At the gravel pit Dr. Woodward removed a knife-like scraper from a bed of bison bones. At the pit had also been found, prior to the arrival of Dr. Merriam and his party, a number of Yuma type artifacts, and one large blade of extraordinary workmanship.<sup>3</sup> This latter had been completely encrusted with a lime-like deposit. It was unearthed from the bluish sands along with a mammoth tooth by one of the workmen for the road company, and though it cannot be offered as proof of association, it is more than likely, in view of other evidence, that it was actually deposited in the blue sands. In order to reach the gravel below the road company had to remove the blue sands, which were scooped off and piled around the edge of the pit. In these dumps a number of the same kind of Yuma type points were found that were also found weathering out of the top of the same deposits in other lake beds in that area. These types were found only on or in the top of the blue sands in these lake beds, and though no Folsom points were found in place, they were invariably found in the lake beds, and more often near the edge of a shelf or "erosion island" of bluish sands. In front of the "hearth" in Anderson Lake many fragments of Folsom points were found resting on the caliche.

These types are highly specialized by having a longitudinal groove that extends along both faces, or sometimes only one face, of the spearpoint, and they and the Yuma types are easily recognized by the remarkably fine secondary chipping.

At the gravel pit bison bones were found to be so numerous that the bluish-gray sands are packed with them from top to bottom, mostly concentrated nearer the top. Some leg bones were found articulated in upright

<sup>2</sup> Howard, E. B. Evidence of Early Man in North America. Museum Journal, Univ. Museum. Univ. of Penna., Vol. XXIV, nos. 2-3, 1935.

<sup>3</sup> For detailed descriptions and plates of these articles, see reference footnote 2.

position. Remains of at least three elephants were discovered at the pit; but these bones did not extend to the bottom of the blue sands.

In every "blow-out" or old lake bed examined, bison and mammoth bones were found weathering out of the top of these same deposits. In several instances leg bones were articulated — the phalanges and metapodials and femur and tibia of an elephant in one case. At Anderson Lake the top of the blue sands is practically level all around, and mammoth bones were discovered in the top of this deposit at several places. The hearth already mentioned was approximately three feet below these outcroppings of mammoth bones.

In many other old lake beds beautifully chipped Yuma knives were found in the top of the blue sands, the upper surface of the artifacts polished smooth by sand-blasting, and the underneath side encrusted with a lime-like deposit. In one place where bison bones were particularly plentiful, and together with mammoth bones were weathering out of the surface of those exposed deposits, we picked up everything that showed on the surface within a radius of about twenty-five feet, so that not a fragment of flint or bone showed. At the end of about three weeks, during which several rather bad dust storms had occurred, we returned to find two or three points of the Yuma type lying flush with the surface, smooth on the upper face and usually encrusted underneath.

With similar evidence from a number of other sites in the Southwest, there seems to be little doubt that man lived in America contemporaneously with certain types of animals that later became extinct. But it seems to be increasingly clear that the time of this extinction is hard to fix, and that other methods will have to be used to date such finds.

**THE OCCURRENCE OF FLINTS AND EXTINCT ANIMALS IN PLUVIAL  
DEPOSITS NEAR CLOVIS, NEW MEXICO, PART II,—AGE  
OF THE CLOVIS LAKE CLAYS**

BY ERNST ANTEVS.

The sites, 15 miles south of Clovis in eastern New Mexico, where Edgar B. Howard has found in lake clays Folsom points and other artifacts in association with bones of mammoth and extinct bison were visited in the summer of 1934. In company with Mr. Howard, the writer had opportunity to become familiar with various conditions indicative of past climatic changes in New Mexico and of the age of the Clovis lake clays. A grant from the Carnegie Institution of Washington is acknowledged.

**PHYSIOGRAPHY AND CLIMATE OF THE CLOVIS REGION**

Clovis is located on the Llano Estacado, or Staked Plains, some 40 miles from its northern and western edges. The Llano Estacado essentially forms the original upper surface of the Miocene and Pliocene Ogallala formation. This formation is of fluvial origin and consists largely of unconsolidated silt with some sand and gravel occurring in west-easterly extending ribbons evidently marking old river courses (1). The materials are frequently cemented by lime. The western edge of the Llano Estacado is a very gentle cuesta with the scarp towards the Pecos Valley (2). The erosion of the Pecos and the upper Canadian valleys has severed the Staked Plains from the mountains in the west and northwest—the mountains which supplied the materials of the plains. The crest of the cuesta stands in the northwestern corner at an elevation of 5000 feet and west of Clovis at about 4600 feet. The surface slopes gently east-southeastward, Clovis having an altitude of 4260 feet. As a consequence only a few small intermittent streams occur in the northwestern part of the Llano Estacado, and the late Tertiary land surface is almost untouched by erosion. There is no stream near the localities of the artifacts.

However, the land surface is not perfectly flat, but contains shallow saucer-like depressions as well as dune ridges. Many of the depressions result from a settling of the surface, because the percolating ground water has compacted the material and removed soluble constituents (3); but those south of Clovis in which the clay with the artifacts is exposed have been caused by wind erosion, by local blowing away and accumulation into dunes of the eolian sand which covers much of that region. Some of the basins, but not those here considered, contain temporary or permanent ponds or lakes.



The precipitation at Clovis is 18 inches a year. It occurs largely during the summer months. The mean temperature for the year is 57° F. and for the months of June–August 76° (4). The climate is classified by Russell (5) as a hot steppe climate with winter deficiency of precipitation, and by Thornthwaite (6) as a semiarid, mesothermal climate with deficient rainfall at all seasons.

#### THE CLOVIS BEDS

The beds exposed some fifteen miles southwest of Clovis and an equal distance to the southeast show a varying cross-section. The following is a generalized profile with data on fossils and artifacts from the other reports:

At top, several feet of red-brown, wind-blown sand.

A few feet of blue-gray clay—a lake deposit—forming one to three distinct beds and containing:

Bones of mammoth and extinct bison.

Molluscs now living under higher latitudes and at higher elevations.

Diatoms all of which are still living in approximately the same latitude. Upward increasing percentage of the saline forms suggests increasing aridity. The diatoms constitute a minor part of the material.

Folsom points, other points, and other artifacts.

Charcoal and burned animal bones. One hearth several feet below the levels of the bison and mammoth bones.

Yellow sand with bones of horse and camel, but without artifacts.

On the east side of the pit, 15 miles southwest of Clovis, this profile was measured (see Plate 17):

- d) At top, several feet red-brown, wind-blown sand.
- c) {
  - 3) 3 feet (average in exposure of 1933, 17 inches) light blue-gray clay.  
Bones of mammoth and bison, artifacts.  
Sharp limit.
  - 2) 15 inches dark blue-gray clay grading into underlying bed. Bones of mammoth and bison.
  - 1) 2 feet (average in 1933, 18 inches) medium light blue-gray clay.  
Bones of bison and, in upper part, of mammoth.  
Sharp limit.
- b) 2½ feet silty clay, cream-colored with gray or pink spots.  
Sharp limit.
- a) 5 feet red-brown sand with some gravel.

The blue lake clay being unique in the Clovis region, the moist age during which it was deposited may have been exceptional for the local conditions. The bones of mammoth and of an extinct species of bison indicate a considerable antiquity of the clay. And the lower temperature, judged from the mollusc fauna, suggests that it is of late glacial age or older, for the temperature has not been much lower than at present during

any part of postglacial epoch either in Europe(7), or, as far as known, in North America (8), and the major temperature fluctuations seem to effect the entire northern hemisphere. Rainfall being regional or zonal, the knowledge of its great postglacial variations in the northeastern States and adjacent Canada, or in Europe, cannot be applied to New Mexico.

Of the three main evidences for a remote moist and/or cool period in New Mexico, viz. mountain glaciers, lakes, and stream terraces, the two first mentioned will be briefly considered. The river terraces, so well mapped and described by Nye (9) in the Roswell region 100 miles southwest of Clovis, are excellent evidence of changes in moisture during the Quaternary, but do not yet seem to furnish any direct data on the age of the moist and dry periods they record, which, as Nye points out, may correspond in a general way to the glacial and interglacial-postglacial epochs.

#### MOUNTAIN GLACIATION

The altitudes of the catchment basins of the youngest extensive glaciers in the San Juan Mountains just north of the New Mexico-Colorado state line are mostly over 12,000 feet, and the surrounding walls rise to altitudes of about 13,000 feet (10). These glaciers were contemporaneous with the last, the Wisconsin, continental glaciation in the northern half of the North American continent. More precisely they may have been correlatives of, or may have climaxed closely upon, the culmination, some 25,000 years ago, of the Des Moines-Dakota lobes of the Keewatin ice sheet (11, 12). The altitude of the Wisconsin snowline in the southern Rocky Mountains has been determined by Klute (13) at roughly 12,500 feet. Since in New Mexico no large mountain tracts, but only summits, chiefly in the Sangre de Christo Range, rise above 12,000 feet, the Wisconsin glaciation there was necessarily of very limited extent.

At least some of the cirques observed by Stone in the Sangre de Christo Range and in the New Mexican part of the San Juan Mountains may have contained glaciers during the Wisconsin age (14). Glaciers may have existed at the same time in some of the numerous cirques observed by J. E. Webb and W. A. Averill in the mountains just northeast of Santa Fe, on the few summits rising above 11,700 or 12,000 feet—the necessary altitude (15). The longest glacier measured seven miles and extended to an altitude of about 9200 feet, the lowest level to which the ice is known to have descended in the region.

Using field glasses, Mr. Howard and the writer observed from the north end of Eagle Nest Lake in the Sangre de Christo Range what appeared to be two small fresh cirques on summits to the west. No cirques were seen on Baldy Peak five miles north of Eagle Nest Lake. Similarly by means of field glasses, another probable fresh cirque was seen from a distance of a

few miles on the northeast side of Cerro Blanco, which is some 12,003 feet high and located 75 miles due west of Roswell, or south of the center of the state. Stone found no moraines on Cerro Blanco (14). If these scars or depressions are fresh cirques of small cliff glaciers, they may date from the last glacial epoch.<sup>1</sup>

During the Wisconsin age the snowline stood 600 to 700 meters lower than at present in the Rocky Mountains and 1000 to 1400 meters lower in the Cascades-Sierra Nevada (13). The discrepancy between these two sets of figures is in harmony with the general rule, that the Pleistocene snowline underwent a smaller depression in the regions that at present have a light precipitation than in those which now have a heavy rainfall (17). Since the altitude of the snowline is chiefly a function of the summer temperature and the snowfall, and since the Wisconsin temperature lowering may have been practically the same in the southern Rockies and in the Sierra Nevada, the different amounts of depression of the snowline may signify a different precipitation factor in the two regions. The fact that the snowline depression in the Rockies was below the average—which was 800 to 1000 meters (17, 18)—and in the Sierra Nevada was above the average suggests that the snowfall during the Wisconsin was in the Rockies smaller, and in the Sierra Nevada larger than at present.

If the precipitation factor had been the same in the two regions the depression of the snowline during the Wisconsin probably would have been intermediate of 650 and 1200 meters, or about 925 meters. In the Rocky Mountains, where the modern snowline drops some 800 meters from lat. 37° to lat. 45° N. (13), while the average annual temperature decreases from 47° to 40° F. (19) and the snowfall does not change greatly (20), the Wisconsin lowering of the snowline of 925 meters would correspond to a mean temperature 8.1° F. lower than that of today. In the Sierra Nevada-Cascade Range, where the modern snowline drops about 1900 meters from lat. 40° to lat. 50° N., while the mean temperature decreases from 60° to 45° F. and the snowfall changes little, the sinking of the Wisconsin snowline of 925 meters would correspond to a 7.3° F. lower temperature. At the culmination of the Wisconsin glaciation the mean annual temperature in the Southwest thus seems to have been about 8° F. (4.4° C.) lower than the present. This result is in good agreement with Klute's (17, 18) former estimate, based on the depression of the snowline on the whole earth, of the temperature lowering during the last glaciation at 4° to 5° C. (7.2° to 9° F.) and with Penck's (21) estimate at 4° C.; but it is low in comparison

<sup>1</sup> In so far as the phenomena described by Ellis are referable to glacial action they may date from a pre-Wisconsin glaciation, and so have no bearing on the Clovis problem (16).

with Penck's (22) recent estimate of the lowering at  $5^{\circ}$  to  $6^{\circ}$  C. ( $9^{\circ}$  to  $10.8^{\circ}$  F.) and Klute's (23) at  $7^{\circ}$  C. ( $12.6^{\circ}$  F.).

#### PLUVIAL LAKE ESTANCIA

In central and southern New Mexico there are a few closed basins, now almost or entirely dry, which sometime contained permanent lakes (24). One of these is the Estancia basin south of Santa Fe which has been studied by Meinzer (25). This basin comprises 2000 square miles. The floor stands at an altitude of about 6000 feet, and the valley is bordered on the west by mountains that rise to 8000 or 9000 feet and along other sides by mesas and hills. In the lowest part of the nearly level plain there are numerous distinct depressions whose flat bottoms practically coincide with the ground-water level and are covered by a salt crust or at times by water. The depressions are excavated by the wind.

The ancient Lake Estancia, at its greatest extension, had an area of about 450 square miles and a maximum depth of almost 150 feet. It stood about 6200 feet above sea level. There was no outlet, but porous rocks perhaps permitted leakage from the basin (26). The several shore lines are approximately of the same freshness. If we assume that the lake held its highest level at the culmination of the Wisconsin mountain glaciation, the mean annual temperature at the lake was probably about  $43^{\circ}$  F., for the modern average temperature at Willard (27), located in the basin and standing at an altitude of 6086 feet, is  $51^{\circ}$ , and the lowering, as stated, was probably about  $8^{\circ}$ . The lake would have been in some respects comparable to Lake Tahoe in the Sierra Nevada. Lake Tahoe stands at the elevation of 6223 feet, and the average temperature at Tahoe is  $42^{\circ}$  F. (28). However, Lake Tahoe is extraordinarily deep and therefore cool; Lake Estancia was comparatively shallow and consequently warm in summer time.

The annual evaporation from a floating pan in Lake Tahoe has been determined by Edwin Duryea, Jr. at 30.5 inches (29). The evaporation from a pan on land at Tahoe is 42 inches (30). Observations in Nevada led Bigelow to the conclusion that the evaporation from a lake surface is about five-eighths of that from an isolated evaporation pan on land (31). Five-eighths of 42 is 26. Carl Rohwer and Robert Follansbee find that the evaporation from a reservoir surface is 0.7 of that from a U. S. Weather Bureau class A pan (32). Seven-tenths of 42 is 29.4. The relationship between the evaporation from a reservoir and from a floating pan varies greatly, but the average coefficient is 0.83 (32). 0.83 of 30.5 is 25.3. The annual evaporation from Lake Tahoe is therefore probably about 25 inches. That from Lake Estancia, if the lake had culminated when the temperature of the region was  $43^{\circ}$  F., surely would have been somewhat greater, perhaps about 30 inches.

The evaporation ( $e$ ) from a lake surface ( $L$ ) in a closed basin equals the precipitation ( $p$ ) over the lake plus the amount of water brought into the lake by the tributaries, i. e. the run-off ( $r$ ) of the drainage area ( $D$ ).

The relationship is thus: 
$$\begin{pmatrix} L.e = L.p + D.r. \\ e = p + \frac{D}{L}.r. \end{pmatrix}$$

Lake Estancia was 450 square miles and its drainage area 1550 square miles (33); and therefore 
$$\begin{pmatrix} e = p + \frac{1550}{450} r = p + 3.44 r, \\ r = \frac{e-p}{3.44}. \end{pmatrix}$$

Assume in agreement with the comparatively high Wisconsin snowline in the Rocky Mountains that, during the growth and climax of the Wisconsin glaciers, the precipitation in the Estancia basin was smaller than at present, or 10 inches over the lake, it now being 13 inches in the lower parts and averaging 17 inches for the entire basin. Assume furthermore that the annual evaporation amounted to 30 inches. As can be figured by the given formula, a run-off of 5.8 inches would have balanced the lake level. So large a run-off is unreasonable, for the rainfall would have been only some 16 inches in the mountains and would have averaged 13 inches for the entire basin. Lake Estancia could not have existed under the assumed conditions, although these are distinctly moister than those now prevailing. It probably could not have existed, if the precipitation had equalled the modern, for this would have required a run-off of five inches. Therefore, at most only a small lake may have occupied the Estancia basin during the ages of growth and of culmination of the Wisconsin glaciers in the Rocky Mountains.

The large Lake Estancia, in discord with the glaciation in the adjacent mountains, may have culminated when the climatic conditions were unfavorable for mountain glaciation, i. e. when the temperature was rather high and the rain precipitation heavy. To be sure a higher temperature would induce greater evaporation from the lake, but it would be unfavorable for glaciation. An increase of the rainfall would effect the summer precipitation most; and, because of rapid run-off, rains would be more favorable for the lake than snows which would to a much greater extent evaporate in the mountains. Perhaps a reasonable combination of factors would be 35 inches of evaporation, 20 inches rainfall on the lake, and consequently 4.4 inches run-off. An evaporation of 35 inches would represent an average temperature of 47° F.; and 20 inches would be 50 per cent heavier rainfall than at present. If there was leakage of the basin, the precipitation was probably still heavier.

Just as the development of the Wisconsin ice sheets in the northern half of the continent postulated a heavier snowfall in the region between the

Rockies and the Hudson Bay as well as in the Labrador Peninsula (34, 12), so their waning was in part caused by a decrease of the precipitation. Since the total evaporation and precipitation on the earth may not have varied appreciably, these changes were connected with opposite changes in other parts of the world. At the culmination of the last ice sheets precipitation began increasing in non-glaciated regions. The North Pacific and the North Atlantic low-pressure areas then being moved far south, and a low-pressure belt extending practically across the southwestern and southern states (35, 36), the rainfall in the Estancia Valley may have then increased.

The retreat of the ice after the culmination, roughly 25,000 years ago, of the western mountain glaciers and of the rejuvenated Keewatin ice sheet indicates rise of the summer temperature and decrease of the snowfall. However, events and conditions in southern Ontario and Quebec and the related history of the Great Lakes suggest that the age about 24,000 to 15,000 or 14,000 before our time, the Middle lateglacial, had comparatively cool summers (37, 38). Thereafter the temperature rose rapidly. In Scandinavia it attained its present level 8500 years ago (7), and in the northern States and southern Canada it may have done so at about the same date (39). In the Southwest the modern temperature conditions were probably attained earlier, perhaps 10,000 years ago. Although there were at that time large remnants of the ice sheets in northern Canada, the gradual adjustment of the climate from glacial to postglacial-modern may have been accomplished in the southern half of the continent.

These several conditions taken into consideration, it seems probable that Lake Estancia held its highest stand some 15,000 years before our time. Well-developed shore lines show that the later subsidence of the lake was interrupted by halts and rises.

#### SUMMARY AND CONCLUSIONS

From the amount of depression of the snowline the annual mean temperature during the culmination of the Wisconsin glaciers in the Southwest is calculated at 8° F. (4.4° C.) lower than today, and the precipitation in the southern Rocky Mountain region is found to have been smaller than at present. Still, because of the reduced evaporation accompanying the lower temperature the climate was distinctly moister than in modern times, and the Estancia basin south of Santa Fe perhaps contained a small lake. The basin seems to have held its greatest water body, a lake of 450 square miles, at a time when the climatic conditions were unfavorable for mountain glaciation, *i. e.* when the temperature was rather high and the rain precipitation heavy. This was probably about 15,000 years ago.

At Clovis, 160 miles to the east, the climatic evolution was probably the same as in the Estancia Valley. The climate may have been distinctly

moister than at present from long before the Wisconsin climax of the Rocky Mountain glaciers till some 11,000 years ago, and moistest roughly 15,000 years before the present. The blue clays containing the artifacts in association with bones of mammoth and extinct bison were deposited in lakes which undoubtedly belonged to the Brazos River system then extending northwestward to the vicinity of the cuesta which forms the western margin of the Llano Estacado. The beds in the clays indicate fluctuations of the water level, as do the several shorelines of Pluvial Lake Estancia. The artifacts probably sank a little in the soft clay, but their occurrence at a depth of 17 inches suggests burial before the clay deposition had come to an end, or 13,000 to 12,000 years before our time.

Later the lake basins were filled by eolian sand. This is now being locally removed by the wind whereby the Pluvial lake clays are exposed.

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DESCRIPTIONS OF NEW BIRDS FROM BOLIVIA, WITH NOTES  
ON OTHER LITTLE-KNOWN SPECIES<sup>1</sup>

BY M. A. CARRIKER, JR.

The collection of birds upon which the present paper is based was made by the author, in company with his son Melbourne R. Carriker, for the Academy of Natural Sciences of Philadelphia. The expedition arrived in La Paz at the end of June, 1934 and left that city for New York on February 1st, 1935. The work was confined to the highlands around La Paz and from the crest of the eastern cordillera of the Andes downwards into the upper Rio Beni and down that stream as far as Reyes. A considerable portion of the area covered had never been previously explored by any ornithological collector.

About 575 species of birds were taken, of which quite a number prove to be new to science, and are herewith described.

My sincere thanks are due to the Carnegie Museum, the U. S. National Museum, and the American Museum of Natural History, for the privilege of examining material in those institutions pertinent to the present paper, and special thanks are due to Mr. Todd, Dr. Friedman, and Mr. Zimmer for their assistance while visiting their respective institutions. Also my thanks are due to Mr. Kinnear of the British Museum for his kindness in making comparisons with types of birds in his department.

Lastly my thanks are due to Dr. Witmer Stone, our Curator of the Department of Vertebrate Zoology, for his helpful suggestions from time to time as the work progressed, and most especially to our Managing Director, Mr. Charles M. B. Cadwalader, for his untiring efforts for the advancement of the work in South America during the past six years.

The names of all colors, used in the descriptions, which are capitalized are taken by direct comparison from Ridgway's "Color Standards and Nomenclature," 1912.

**Ciccaba minima**, sp. nov.

Type from Sta. Ana, Rio Coroico, Dept. La Paz, Bolivia, alt. 2200 feet. No. 121064, A.N.S.P., ♂ adult, collected July 15, 1934 by M. A. Carriker, Jr., original No. 9086.

*Diagnosis*: Its nearest relative seems to be *C. acquatorialis* Chapman, of east Ecuador, but it is considerably smaller than that species, in fact the smallest known species of the genus, having the wing but 190 mm. and the

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<sup>1</sup> Preliminary results of explorations supported in part by a grant from the Penrose Fund of the American Philosophical Society.

tail 110 mm. In some respects it resembles a large *Otus*, except for the absence of ear-tufts.

*Description of the type:* Bases of the upper nasal plumes and a narrow eyebrow black; the apical, hair-like portion of the long nasal plumes black and extending 10 mm. beyond tip of bill; frontal feathers white at base and cinnamon buff apically; pileum and nape dark brown, finely barred and vermiculated with black, and with a patch over each eye white, finely barred with blackish; back and scapulars sandy brown, with fine, wavy, black cross lines and vermiculations, and with considerable white across the nape in the form of a collar; outer webs of outer scapulars with a large sub-terminal white spot; wing coverts and tertials about like back, except paler, with more whitish and sandy buff vermiculations; outer median wing coverts with some large creamy white spots on the outer webs; outer webs of primaries and secondaries Cinnamon, with broad black bars, which are intermixed with Hazel; inner webs blackish, with rather broad bars of Cinnamon opposite the blackish bars of the outer web and of the same width; entire tips of primaries and secondaries uniform Cinnamon; sides of head and throat finely barred with whitish, sandy buff and black; breast whitish, the feathers with fine dusky shaft lines and about five narrow, broken cross bars and some vermiculations of dark brown, and the tips of the feathers slightly washed with ochraceous; abdomen, sides and flanks white with shaft stripes of Warm Sepia (broader than on breast) and about three narrow, broken cross lines of the same color, and with some mottling at the tips of the feathers; under tail coverts creamy white, with a few faint, pale brown cross lines towards the tips of the longest feathers; tibiae and tarsi, thickly feathered to base of toes, Cinnamon Buff; toes entirely naked; tail above Vinaceous Tawny, with broken, blackish bars, the black bar on the outer web being opposite the pale bar of the inner web; on the under side of the tail the Vinaceous Tawny is replaced by Pale Pinkish Buff; under wing coverts the color of the tarsi, mottled with blackish along the outer portion; edge of wing creamy white; inner webs of remiges (below) broadly and evenly barred with black and Light Pinkish Cinnamon. The ear tufts are very short and inconspicuous, scarcely to be differentiated from the feathers of the nape.

*Remarks:* In *C. aequatorialis* there is no white patch above the eye on the sides of the pileum; the spots on the scapulars are ochraceous instead of white; the wings are different in color and the outer primaries longer, but the wing formula is practically the same; the tips of the remiges are mottled with dusky, not immaculate; the inner webs of the remiges have broad, very faint bars of pale buff, with the blackish interspaces much broader than the light bars; the whole of the under parts are rich ochraceous or fulvous, the breast with dusky shaft streaks and bar-like mottling and with some whitish vermiculations; the dusky shaft stripes on the abdomen are twice the width of those in *minima*, and with the feathers wholly cinnamon ochraceous basally but with broad tip whitish and with two or three narrow cross lines of dark rufous brown; crissum rich tawny ochraceous, with longest feathers white tipped; barring of tail more broken.

***Crypturellus cinereus cinerascens*, subsp. nov.**

Type from Chatarona (near Reyes), Dept. Beni, Bolivia, No. 119455, A.N.S.P., ♂ adult, collected Sept. 30, 1934, by M. R. Carriker, original No. 10319.

*Diagnosis*: Similar to *C. c. cinereus* of the Guianas, but very much more sooty gray both above and below (less brownish) and with the front and superciliary region ashy gray in contrast to the dull cinnamon brown of the pileum and nape (absent in *cinereus*). Occiput and nape Mars Brown; upper parts about Fuscous, and under parts uniformly Clove Brown.

Another male taken at Chiñiri, on the Rio Kaka (Upper Beni) is exactly like the type. Compared with two skins from Cayenne; two ♀♀ from the Rio Tapajos and two ♂♂ from the Rio Purus, and one ♂ and one ♀ from Benevides, Pará, Brazil. All of these birds are quite uniform in color, those from Cayenne apparently being the darkest above, but very much browner than the Bolivian birds. All the others are quite brown both above and below, one skin slightly sooty above, but the others almost umber brown, with the pileum and nape dark ferruginous brown, while none approach the Bolivian skins in the sooty gray shade of the under parts.

***Crypturellus soui inconspicuus*, subsp. nov.**

Type from Susi (near Rurrenabaque), Rio Beni, Bolivia, No. 119473 A.N.S.P., ♂ adult, collected Sept. 14, 1934 by M. A. Carriker, Jr., original No. 9972.

*Diagnosis*: Resembles somewhat *C. s. modestus* in a superficial manner but the pileum is dark brown, almost concolorous with the mantle, while the back and wings are much browner (more buffy brown), with none of the dark burnt umber tinge peculiar to *modestus*. The throat is pure white as in *modestus*, but the under parts are much paler and duller colored.

*Description of subspecies*: Pileum and nape Mummy Brown (Fuscous in the females), back and wings about Prout's Brown; median and greater coverts Fuscous; rump and upper tail coverts darker, rich brown, about Bister; sides of head and sides of neck a little paler than pileum; chin and throat pure white; foreneck and upper chest about Sepia, blending into Dresden brown on lower chest, with a slight admixture of fulvous; breast and upper abdomen Light Buff, darker on sides and upper flanks; vent whitish; flanks and under tail coverts about the color of upper chest and obscurely barred with creamy buff; under wing coverts ashy white; under side of quills pale ashy basally, becoming darker towards the tips.

Iris brown; bill black above, yellowish flesh below; feet olive.

*Remarks*: In addition to the type there are the following skins: 1 ♂ and 1 ♀ from Teoponte, Upper Rio Kaka; 2 ♀♀ from Chiñiri, Lower Rio Kaka, and 1 ♀ from Sta. Ana, Rio Coroico. A single ♂ from Saposoa, Dept. San Martin, Peru is almost exactly like the type, having the pileum a little darker (about like the Bolivian females) and with the back and

chest a little darker. The females are uniformly more richly colored, below than the males, having the whole under parts about Clay Color, a little darker on the sides and a little paler on the median line, while the flanks have more conspicuous fulvous barring.

In the Carnegie Museum collection are four ♀ ♀ and one ♂ from Rio Surutú, Rio Yapacani, and Cerro Hosane, Bolivia, which apparently belong to this new race. Compared with an adequate series of typical specimens of *Crypturellus s. soui*, *modestus*, *meserythrus*, *mustelinus*, and *nigriceps*.

***Neomorphus geoffroyi australis***, subsp. nov.

Type from Huanay, Rio Mapiri, Dept. La Paz, Bolivia, alt. 1500 feet. No. 120763, A.N.S.P., ♀ adult, collected August 10, 1934, by M. R. Carriker, original No. 9481.

*Diagnosis:* Closely related to *N. g. geoffroyi* of Brazil, agreeing exactly with that race in the color of the upper parts, except for a greater amount of green on the edges of the three outer primaries; the under parts, especially the throat, are quite different. In *geoffroyi* the median basal portion of the feathers of the throat is soiled white, with a subterminal, concentric black bar and with a broad soiled white or buffy white edging around the tip, while on the foreneck there is an additional narrow black edging outside of this whitish terminal band. These heavy, blackish, subterminal bands are found over the whole throat except the chin and the posterior portion adjoining the black pectoral collar. In *australis* the whole of the throat except the median portion, down to the black pectoral band, has feathers sooty black, with a narrow soiled white, concentric band circling around the median portion of the feather and a narrow, marginal edging of the same color, so that the whole of the lateral portions of the throat have a scaled appearance, blackish, with narrow, whitish, semicircular bands; the upper throat and the posterior portion next to the pectoral collar are plain soiled white, more ashy on the concealed portion of the feathers and with very narrow dusky margins on the lower portion of the throat; in the middle part of the throat the feathers have a slight dusky area along the shaft; the pectoral band of black is considerably narrower in the new race, especially in the middle, where it is almost broken; the breast is ashy, rather than soiled white, washed with buffy brown; the flanks are dull rufous and crissum brownish black, with the flanks paler in the new race and the crissum darker; the under side of the tail is more greenish, less purplish. Size the same.

*Remarks:* Another female was taken at Sta. Ana, Rio Coroico, Bolivia, which is like the type, except that it has the breast paler gray, and with the flanks and crissum slightly paler.

A male and female from Huacamayo, Dept. Puno, Peru, taken by the author in July, 1931 are not quite typical of *australis*, being somewhat intermediate between it and *geoffroyi*, having the throat a little paler, but the color pattern of the throat feathers is the same as the bolivian birds, as well as the color of the rest of the under parts, which agree in that

respect with the type. The pectoral collar, however is considerably broader than in the Beni birds, about as in *geoffroyi*, being of uniform width across the whole breast. This seems to be the first record of the occurrence of the species in either Peru or Bolivia.

***Doryfera ludoviciae* grisea**, subsp. nov.

Type from Calabatea, Rio Coroico, Dept. La Paz, Bolivia, alt. 4,500 feet. No. 120803, A.N.S.P., ♀ adult, collected November 9, 1934 by M. A. Carriker, Jr., original No. 10346.

*Diagnosis*: Differs from *D. l. ludoviciae* of Colombia in larger size and longer bill; ashy gray under parts, but faintly washed with bronze green, and in having the rectrices black instead of dark steel-blue. From *D. l. rectirostris* of east Ecuador and northeast Peru it differs in the pale ashy gray (Smoke Gray) of the under parts (dark sooty, washed with grass green in *rectirostris*); pale ashy gray under tail coverts (instead of steel-blue, washed with blue and blue-green); much less coppery red on the nape. The type of *grisea* is slightly smaller than *rectirostris* (wing 1.5, tail 2 mm. less).

*Measurements of the type*: Length (in flesh), 125 mm.; wing, 56 mm.; tail, 34 mm.; bill, 33 mm.

*Remarks*: Compared with three skins of *ludoviciae* from Colombia and two skins of *rectirostris* from Rio Jelashte, northeast Peru. Apparently the only Bolivian records for this species are those given in the "Catalogue of the Birds in the British Museum," 1 ♂ from Tilotilo and two other skins without specific locality, all collected by Buckley.

***Leucippus chionogaster hypoleucus*** (Gould).

*Trochilus hypoleucus* Gould, P. Z. S., 1846, p. 90 (Bolivia).

Four ♂♂ from Calabatea and Sandillani, Bolivia seem to be referable to this form. Compared with 8 skins of *chionogaster* from Huacapistana, Auquimarca, and Rio Jelashte, Peru, and with 3 ♂♂ from Oconeque, south Peru. The Bolivian birds undoubtedly represent a race distinct from *chionogaster*, being much whiter below and with the white portion of the outer rectrices not so long (dusky tips wider). Gould's description of *hypoleucus* agrees very closely with these birds. There are two names which might be used for this race,—either *hypoleucus* Gould or *pallidus* Taczanowski. If Gould's bird was really this form, his name would apply, being the older. However we have the curious anomaly of the three Oconeque birds, which, while largely white below, have almost no white on the outer rectrices, merely a little along the inner edge of the inner web. Whether they should be separated is a question. The characters given by Taczanowski for *pallidus* seem to be individual. One bird has the median rectrices quite bluish, and another bronze green, while the upper parts also vary in the shade of bronze-green. Neither Gould nor Taczanowski have

described correctly the tail characters of the Oconeque birds, so that neither *pallidus* nor *hypoleucus* seems to apply to them. Were Bolivian birds like them in tail characters, I would not hesitate to give them a name, but it hardly seems probable that there could be three races of this species in so small an area.

Bolivian birds have the wing shorter and the bill longer than typical *chionogaster*, which in addition to the color of the under parts, seems sufficient to separate them under Gould's name of *hypoleucus*.

***Chloronerpes leucolaemus australis*, subsp. nov.**

Type from Sta. Ana, Rio Coroico, Dept. La Paz, Bolivia, altitude 2200 feet. No. 120683, A.N.S.P., ♂ adult, collected July 15, 1934 by M. A. Carriker, Jr., original No. 9085.

*Diagnosis:* Differs from *leucolaemus* of Brazil as follows: Greater extent and brighter golden olive on chest (about Orange Citrine); throat with much heavier black spotting (in *leucolaemus* soiled white with only a few dusky markings at lower edge); foreneck and chest with the whitish markings wider and rounded (not linear); black barring of lower breast and abdomen wider and regular (not crescentic markings); red malar stripe narrower; auriculars more nearly the golden yellow of the rictal strip (not olive yellow); upper parts the same color (a little paler than Orange Citrine); under wing coverts and lining of wings darker hazel. The female differs in the same manner as the male, but in addition it has the red confined to the nape, not extending nearly so far up over the occiput.

*Remarks:* In addition to the type, 2 ♂♂ and 1 ♀ were taken at the same locality. In the collection of the Carnegie Museum are 16 skins from Rio Surutú, Rio Yapacani, Buenavista, and Cerro Hosane, all belonging to this new form. It also extends northward into Peru, 1 ♂ from Moyobamba and 1 ♀ from Chanchamayo being in the collection of this Academy, while Taczanowski records a specimen from Monterico, collected by Jelski (Orn. Perou, Vol. III, p. 85, 1886). The two males in the Academy collection are very close to the Bolivian series, the only appreciable difference being in the Moyobamba bird, which has somewhat fewer whitish spots on the chest.

***Celeus jumana saturata*, subsp. nov.**

Type from Chatarona (near Reyes), Dept. Beni, Bolivia. No. 120669, A.N.S.P., ♂ adult, collected September 24, 1934 by M. A. Carriker, Jr., original No. 10207.

*Diagnosis:* Resembling *C. j. jumana* of Brazil in general color and color pattern, but considerably darker both above and below, with paler, more yellowish rump and upper tail coverts, paler sides and with spots on under side of secondaries extending to their tips, while in *jumana* the whole of the tips are cinnamon rufous.

The head, back and under parts are darker, especially the under parts (between Prout's Brown and Mummy Brown), with the blackish basal portion of the feathers showing, only the tips being brown; the auriculars are more blackish (less chestnut); the under wing coverts, sides, flanks and rump very much paler, the under wing coverts pale sulphur, with edge of wing Cream Buff; the sides a little deeper sulphur, with a slight wash of Cream Buff; the rump Primrose Yellow and longer upper tail coverts Hazel; the wing coverts, scapulars and inner tertials are dark brown, decidedly barred with Hazel (but faintly indicated in *jumana*); the broad blackish bars on the inner web of the secondaries extend nearly to their tips, in the form of a large spot on each side of the rib, and all of these feathers have a black spot at the tip (in *jumana* the whole apical portion of the secondaries is plain Hazel).

The female is paler than the male, but darker than the female of *jumana*, but has the under wing coverts and sides creamy white, with no tinge of sulphur, while the rump is Cinnamon Buff in abrupt contrast to the dark Hazel of upper tail coverts (in *jumana* the whole rump and upper tail coverts are uniform, between Orange Citrine and Antique Brown).

*Remarks:* An adult female was taken with the male. Compared with 1 ♂ and 3 ♀♀ of *jumana* from Pará, Brazil, and 1 ♂ from Diamantina, the latter being somewhat intermediate between *jumana* and *saturata*.

***Ecchaunornis chacuru uncirostris*** Sztolcman.

Annales Zool. Musei Polon. Hist. Nat., Tom. V, No. 4, 1926, p. 214. (Sta. Ana, Peru.)

Four ♂♂ and 2 ♀♀ collected at Chatarona (near Reyes), Dept. Beni, seem to be referable to this form. I have compared them with six skins which seem to be more or less typical *chacuru* and find the following differences. Sztolcman's characterization of *uncirostris* rests solely on the length and shape of the bill, and were there no other characters aside from those, it could not be maintained.

The bill does average longer in the Chatarona birds, but the other differences he mentions do not hold. However there are other characters which he overlooked or which his material failed to show. The Beni birds are white on the under parts and auriculars, slightly soiled on the foreneck and abdomen, while in *chacuru* they are decidedly creamy white, deeper on the throat and chest and auriculars; the upper parts are slightly paler brown and the white nuchal collar very much narrower, especially in the median portion, where it is almost concealed by the overlapping feathers of the occiput. The paler color of the back and wings may not hold in fresh specimens, but the color of the under parts and ear coverts and narrower nuchal collar, taken in conjunction with the longer bill, are sufficient to maintain the race. Sztolcman says that a bird from Chulumani, Bolivia, is the same as his two Ucayali types, so that this name will apply to the birds of east Peru and north Bolivia. I suspect that in southeast Bolivia the birds will prove to be the same as those from Paraguay, viz: *chacuru*.

***Monasa morpheus bolivianus*, subsp. nov.**

Type from Rurrenabaque, Rio Beni, Bolivia. No. 120746, A.N.S.P., ♂ adult, collected September 10, 1934, by M. A. Carriker, Jr., original No. 9907.

*Diagnosis:* Agrees with *M. m. morpheus* in the amount of creamy white on the front and chin, in fact there seems to be slightly more than in three skins of that race from Pará, but it differs from both *morpheus* and *peruvianus* in the color of the pileum, the slate gray of the mantle extending unbroken and without change up over the top of the head as far as the middle of the eye, where it changes abruptly to a narrow band of black separating the slate gray of the crown from the creamy white of the front. The whole of the upper parts are paler and grayer (less bluish), about Deep Neutral Gray; the under parts are also slightly paler and with the black area surrounding the whitish chin patch considerably narrower than in *morpheus* and *peruvianus*. Length of wing and tail approximately the same.

Two ♂♂ (in addition to the type) collected at Sta. Ana, Rio Coroico, are exactly the same as the type.

***Antiurus maculicaudatus romainei*,<sup>2</sup> subsp. nov.**

Type from Chatarona (near Reyes), Dept. Beni, Bolivia. No. 121033, A.N.S.P., ♂ adult, collected September 20, 1934 by M. R. Carriker, original No. 10096.

*Diagnosis:* Close to *A. m. maculicaudatus* of Pará, Brazil, in general coloration, but having the tail quite different, as described below:

Superciliary stripe and sides of neck much paler, Light Buff instead of Warm Buff or Cinnamon Buff; the spotting of the throat and chest paler, very little, if any, darker than the superciliaries; abdomen practically immaculate Warm Buff (barred with dusky in *maculicaudatus*); nuchal collar paler, Cinnamon instead of Hazel; spots on pileum paler and smaller, and much more silvery white freckling on the occiput; the back is paler, also the spots on the scapulars and tertials; the tail is quite different, the median pair of rectrices having more white freckling, the remainder being almost uniform black, with broad, immaculate white tips and with but two rounded white spots on the inner webs and a smaller white spot opposite them on the outer web, but the outer webs with no suggestion whatever of the buffy-white bars as in *maculicaudatus*. In the Pará birds the white tips on the rectrices have the apical portion heavily freckled with dusky and pale rufous, but slightly on the outer pair, and increasing in quantity on the succeeding pairs.

*Remarks:* Compared with 2 ♂♂ and 1 ♀ from Pará, topotypes of *maculicaudatus*. The type of *romainei* is in full fresh plumage with much enlarged gonads.

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<sup>2</sup> Named in honor of my son, who collected the type.



**Scytalopus bolivianus** Allen.

*Scytalopus bolivianus* Allen, Bull. Amer. Mus. Nat. Hist., vol. II, 1889, page 98 (Reyes, n. Bolivia).

I have two males of this rare little Babbler, taken at Calabatea and Sandillani, Yungas de La Paz, Bolivia, which have been compared with the type and found to be exactly the same. The type of this species was collected by Dr. Rusby, on his first trip down the Rio Beni, and it is quite certain that it did not come from Reyes, as stated on the label. Dr. Rusby went into the Rio Beni by way of Sorata and Mapiri, and unquestionably this bird was collected somewhere along the road between those two localities. It would not have come from either of them, for Sorata is too high and Mapiri much too low. My two skins were taken at 4,500 and 7,000 feet, respectively. No specimens of *Scytalopus* were taken below Calabatea, while above 7,000 at Sandillani ranges another species which I have not yet been able to identify, and higher up, at timber-line and above is found *S. acutirostris* in abundance.

Dr. Hellmayr states (Birds of the Americas, Vol. III, p. 17) that this species is known from but two specimens, the type from Bolivia and an immature specimen from Sto. Domingo, Dept. Puno, s. Peru (6,000 feet), while he makes it a subspecies of *S. femoralis*. I cannot agree with this allocation. The type of *S. femoralis* is from Chanchamayo, Peru, and I have topotypes from there, as well as a fully adult male from Sto. Domingo, which agrees exactly with the Chanchamayo topotypes.

In view of the differences in color between the two forms, and the fact that they are found together at Sto. Domingo, it is obvious that they are not conspecific, and that *bolivianus* should be given specific rank. In a footnote on the same page Dr. Hellmayr says that Buckley's specimen from the Yungas, Bolivia (identified by Selater and Salvin as *S. sylvestris*) may also belong here, but I doubt very much if that is the case. I think, rather, that it is the same thing of which I have five skins from Sandillani (taken higher up than *bolivianus*), and which I have not yet been able to satisfactorily identify.

**Myrmotherula grisea**, sp. nov.

Type from Sta. Ana, Rio Coroico, Dept. La Paz, Bolivia, alt. 2200 feet. No. 120269, A.N.S.P., ♂ adult, collected by M. A. Carriker, Jr., original No. 9316.

*Diagnosis:* Resembling *M. huxwelli* in the uniform gray of upper and under parts, but differing decidedly from that species in having the entire wing, wing coverts and tail uniform gray like the back, and in the entire absence of the concealed white patch on mantle in both sexes. Female uniform olive brown above and deep cinnamon ochraceous below.

*Description of type:* Pileum, sides of head, sides of neck and entire upper parts uniform Slate Gray; throat and entire under parts uniform Dark

Gull Gray; remiges and rectrices Dark Neutral Gray, with outer webs color of back; wing coverts Slate Gray, with inner basal portion sooty black, and with no trace of paler tips; under wing coverts Light Gull Gray, with inner edges of remiges soiled white. Female Brownish Olive on back and scapulars, pileum and nape a little grayer; sides of head, sides of neck and throat Cream-Buff, rest of under parts Ochraceous Tawny, darker and browner on the flanks and under tail coverts; wings edged with Dresden Brown; tail Prouts Brown, without paler edgings; wing coverts dusky, broadly edged with Dresden Brown; under wing coverts Ochraceous Buff, with remiges edged with Light Buff.

*Measurements:* (Three ♂♂, including type) Length (average) 111 mm.; wing, 56 mm.; tail, 38 mm. (Three ♀♀, average) Length, 105 mm.; wing, 54 mm.; tail, 36 mm. Male, color of iris brown; bill black; feet leaden blue. Female same except bill bluish flesh below.

*Remarks:* All of the six skins of this species were taken at Sta. Ana from the small roving bands of birds, usually in company with *M. axillaris lafresnayana* and *M. m. menetriesi*. It was not seen at any other station either above or below Sta. Ana.

***Herpsilochmus rufimarginatus flaviventris*, subsp. nov.**

Type from Teoponte, Rio Kaka (a few miles below Huanay), Dept La Paz, Bolivia, alt. 1450 feet. No. 120280, A.N.S.P., ♂ adult, collected August 17, 1934, by M. A. Carriker, Jr., original No. 9563.

*Diagnosis:* Differs from both *H. r. frater* and *H. r. rufimarginatus* in greater amount of black on mantle; darker shade of chestnut on wings (about Russet) and in having the whole of the under parts back of throat uniformly Martius Yellow, a little paler on the flanks. The bill is longer and heavier than in *frater*. The ♂ in *frater* has the under parts almost uniformly soiled white, and the ♀ has the chest buffy cream, while in *flaviventris* the under parts are uniformly Martius Yellow in *both sexes*.

In *rufimarginatus* the whole back, scapulars and rump are decidedly olivaceous gray, with but a small amount of black in the median portion of the mantle, while in *flaviventris* the whole median portion of upper parts from nape to upper tail coverts is black, with the sides of mantle and scapulars Pale Smoke Gray, the latter broadly edged with white (more broadly than in *rufimarginatus*); in *flaviventris* the superciliary stripe is pure white, while in *rufimarginatus* it is mixed with dusky and the throat is but little paler than the rest of the under parts, while the Bolivian birds have the throat pure white and rest of under parts clear, pure Martius Yellow, not dusky sulphur; the sides of the head, auriculars and malar region in *flaviventris* are ashy white, flecked slightly with dusky, but in *rufimarginatus* they are pale yellowish olive, flecked with dusky. A ♀ from south Brazil has the pileum darker chestnut than Bolivian birds, back much darker ashy olive, under parts barely tinged with sulphur and with the throat ashy white.

*Remarks:* In addition to the type the following specimens of this race are in the Academy collection: Teoponte, 1 ♀; Sta Ana, 2 ♂♂; Chiniñiri,

1 ♂ and 1 ♀, all from the upper Beni River; Shapaja, Rio Huallaga, Peru, 1 ♂ and 1 ♀. The two Peruvian skins seem to be exactly like the Bolivian series in every way. Taczanowski records this bird from Monterico, and Hellmayr from Yahuarmayo, Peru, and makes the comment that they are, together with Matto Grosso birds, intermediate between *frater* and *rufimarginatus*, but lacked material to do more with them. A single ♂ in the Carnegie Museum from Rio Surutu, Bolivia is apparently the nominate form, but shows a slight divergence toward *flaviventris*. I have not seen birds from Matto Grosso, but according to Hellmayr they are of the type of *flaviventris*, but probably not typical.

**Myrmoborus leucophrys leucophrys** (Tschudi).

I have compared our skins of this species from Chatarona (near Reyes), Rio Beni, Bolivia, with a large series from north, central and south Peru, and not one of them shows characters which cannot be matched in the Peruvian series. Mr. Zimmer states that the birds from Reyes and the Rio Beni belong to a new race which he describes from the Rio Madeira (*griseigula*), which has the lower throat tipped with gray in the male and blending into the gray of the chest, while the female is darker, more rufescent brown on the back, etc. Our Chatarona birds fail entirely to show these characters, agreeing exactly with birds from the headwaters of the Beni and Peru. It is quite probable that lower down on the Beni *griseigula* is present and that even near Reyes there may be intergrades showing to a certain extent the characters of that race, but I believe Reyes should not be included in its range.

**Myrmeciza atrothorax griseiventris**, subsp. nov.

Type from Chatarona (near Reyes), Dept. Beni, Bolivia. No. 120312, A.N.S.P., ♀ adult, collected September 19, 1934 by M. A. Carriker, Jr., original No. 10061.

*Diagnosis:* The male practically indistinguishable from the male of *M. a. obscurata* Zimmer, but the female is quite distinct, being intermediate in color of the under parts between *obscurata* of the upper Ucayali region and *melanurus* of Matto Grosso and the Cochabamba region of Bolivia. The upper parts are close to Dresden Brown, with pileum and nape nearer Sepia, with the front and sides of head ashy gray; the upper throat is white, blending gradually through Ochraceous Buff into Ochraceous Tawny on the chest, then again passing through Ochraceous Buff on breast into creamy white on the lower breast; abdomen Dark Gull Gray and flanks nearer Mouse Gray and crissum Dark Mouse Gray. Tail black.

Three ♂♂ and 1 ♀ from Chiniñiri; 3 ♂♂ from Rurrenabaque; 2 ♀♀ from Chatarona.

***Drymophila caudata boliviana***, subsp. nov.

Type from Sandillani, Prov. N. Yungas, Dept. La Paz, Bolivia, alt. 6600 feet. No. 120323, A.N.S.P., ♂ adult, collected November 26, 1934 by M. A. Carriker, Jr., original No. 10580.

*Diagnosis:* The male is like *D. c. caudata* on the under parts, but like *striaticeps* above, having the whole of the pileum and nape uniformly and heavily streaked with white; the tail is, however, different from both, having the black subterminal area reduced to a band scarcely wider than the narrow white tip, which is but half the width of the white tip in *caudata* and *striaticeps*, while the chestnut of the rump extends much higher upwards, even with the tips of the longest greater wing coverts.

The female of *boliviana* is exactly like the female of *striaticeps* on the upper parts, while on the under parts the ground color is the same but the streaking similar to that of *caudata*.

*Remarks:* Contrary to the views of Dr. Hellmayr, I think that *striaticeps* Chapman, is a perfectly good race, the female differing from that of *caudata* in the much deeper cinnamon fulvous of the pileum and the deeper tone of the ochraceous streaking on the back. The males differ from *caudata* in having the whole pileum heavily streaked with white, while in *caudata* the median portion of the pileum and occiput is pure black. The under parts in the female of *striaticeps* are deeper creamy ochraceous on the chest, belly and flanks, especially the latter, while the streaks are heavier on the chest. The males differ in much heavier streaking on the throat and chest.

Peruvian birds are scarcely different from Colombian, though they show a slight approach to the characters which distinguish *boliviana*. The black streaking of the throat and chest is less sharply defined, and very faint on the throat. I have seen no females from Peru.

Compared with 4 ♂ from north Peru; a large series of *caudata* from Pueblo Nuevo and La Palmita, Santander, Colombia, and a series of *striaticeps* from Sancudo, above Manizales, Colombia.

***Chamaeza mollissima yungae***, subsp. nov.

Type from Sandillani, Prov. N. Yungas, Dept. La Paz, Bolivia, alt. 7,000 feet. No. 120358, A.N.S.P., ♂ adult, collected December 10, 1934 by M. R. Carriker, original No. 10650.

*Diagnosis:* Differs from *mollissima* in paler brown of upper parts; light barrings of under parts creamy white instead of white and bars broken for the most part into irregular shaped spots on each web of the feather instead of continuous bars of uniform width; upper tail coverts with tips deep ferruginous brown instead of color of the back and with whole tail (above) dark chestnut brown instead of sooty black, with narrow brown edgings.

*Description of type:* Whole of pileum, nape, sides of neck, back, rump and shorter upper tail coverts Prout's Brown; longer upper tail coverts Mars

Brown; tail (above) close to Mummy Brown; lores and a long superciliary strip sooty black, mixed with white, this streak extending to the nape, with the feathers of the posterior portion regularly barred with black and white; throat blackish, each feather with a median white cross bar and a terminal, triangular-shaped white spot; chest and breast black with two cross bars and spot at tip of creamy white, the bars broken at the rib; sides and flanks dark brown, the sides more or less barred with cream and with the upper flanks having the longer feathers blackish, broadly edged on both sides with creamy white, and the lower flanks buffy brown with wide, concentric, subterminal bars of black; under tail coverts barred with black and cinnamon; tail below darker than above, especially on the inner webs, which are about Clove Brown; under wing coverts black, slightly mixed with white.

Length (in flesh), 215 mm.; wing, 90 mm.; tail, 83 mm. Bill black; feet dusky horn.

*Remarks:* Taken in the heavy cloud forest above Sandillani by my son, Melbourne Romaine Carriker. The birds are not uncommon here, but exceedingly shy and almost impossible to secure.

***Leptasthenura andicola boliviana*, subsp. nov.**

Type from Kilometer 34, Yungas Railway (east of La Cumbre), Dept. La Paz, Bolivia, altitude 14,000 feet. No. 120406, A.N.S.P., ♀ adult, collected January 13, 1935, by M. A. Carriker, Jr., original No. 11131.

*Diagnosis:* Nearest to *L. a. peruviana*, from La Raya, Dept. Cuzco, Peru, but differing from that race as follows: The pileum same as in *peruviana*, but the white streaks on the mantle wider; the outer webs of the secondaries very much blacker and lacking entirely the rufous patch at the basal portion of the outer webs; rectrices very much blacker and decidedly wider, with the pale area on the three outer rectrices confined to the outer web and a narrow line along the shaft on the inner web (in *peruviana* nearly the whole of the apical portion of the inner web is pale, like the outer web); under parts with almost no trace of buffy brown, except on lower abdomen and lower flanks, the whole of the under parts (except middle of upper throat white) being heavily streaked with black and white, the black streaks narrower on the foreneck, lower throat and sides of neck, thus showing more white; under tail coverts with the black streaks mixed with buffy ochraceous.

Size about the same as in *peruviana*.

*Remarks:* This seems to be the first record of the taking of the species south of the Department of Cuzco in Peru. The type was the only specimen seen. It may be distinguished at once from *peruviana* by the absence of the buffy-brown wash so conspicuous in that race over the whole of the under parts back of the throat and by the much darker tail on the under side. In *aequatorialis* the black and white streaking stops at the breast, the whole abdomen being unstreaked, as well as the crissum.

***Sclerurus albigularis albicollis*, subsp. nov.**

Type from Teoponte, Rio Kaka (a few miles below mouth of Rio Coroico) Dept. La Paz, Bolivia, altitude 1425 feet. No. 120561, A.N.S.P., ♂ adult, collected by M. A. Carriker, Jr., August 20, 1934, original No. 9629.

*Diagnosis:* Most nearly resembling *S. a. propinquus* Bangs, of the Sta. Marta Mountains, Colombia, agreeing with that form in the bright rufous color of the upper tail coverts (Kaiser Brown) and rump and in the dull Cinnamon of the chest, but differing in having the back Snuff Brown (not burnt umber) in sharp contrast to the rump; the pileum and nape are dark brown; the chest slightly paler than in *propinquus*, the Cinnamon extending further posteriorly; the sides and flanks are paler brown and the crissum darker; the throat is almost pure white (a trifle soiled), with almost no trace of ashy gray (as in *propinquus*) on the foreneck; the upper wing coverts are but a trifle ruddier than the back, not bright chestnut. It is larger than *propinquus*, almost as large as *zamorae* of c. Ecuador and n. e. Peru, but differs from that form in the white, instead of gray, throat; paler chest and under parts, and brighter, more rufescent upper parts and with much more and brighter chestnut rufous on rump and upper tail coverts. It differs from *albigularis* in whiter throat and more extensive rufous on chest; more rufescent upper parts and deeper chestnut rufous upper tail coverts, as well as larger size.

*Measurements:* Length (in flesh), 185 to 192 mm.; wing, 90, 92 mm.; tail, 62, 67 mm. Iris brown; bill black, dusky flesh below; feet blackish horn.

*Remarks:* In addition to the type, another male was taken at Sta. Ana, Rio Coroico, which agrees exactly with it. Apparently the first record for the species from Bolivia.

Compared with 1 ♀ of *albigularis* from Mt. Tabor, Trinidad; with 7 ♂ ♂ and 5 ♀ ♀ of *propinquus* from Sta. Marta region of Colombia; with 1 ♂ and 2 ♀ ♀ of *zamorae* from San Ignacio and Tamborapa, Peru.

It is possible that this race extends north into Peru, and that Tschudi's bird with the bright rufous uropygium which Taczanowski referred to "*caudacutus*" belongs here. Another of Tschudi's birds which was supposed to have come from east central Peru (*Pseudocolaptes boissonneautii auritus*) for which Hellmayr designated Maraynioc as the type locality, obviously came from further south, and it may well be that this specimen of *Sclerurus* also came from the same locality.

Two skins from the Rio Yapacani and four from Rio Surutú, Bolivia, in the Carnegie Museum belong to this form, but three from Cerro Hosane are somewhat different.

***Phacellodomus rufifrons peruvianus* Hellmayr.**

In the "Birds of the Americas," page 159, Dr. Hellmayr restricts the range of this race to northern Peru, on the Marañon and its affluents. We have five skins of *P. rufifrons* from Chatarona (near Reyes), Rio Beni,

which cannot be referred to the east Bolivian race of *sincipitalis*. The type of *sincipitalis* comes from near Tucuman, and I have compared these Chatarona birds with four skins of that race from Miraflores, Dept. Oran, northern Argentina, and find them to be quite different. On the other hand comparison with a series of topotypical skins of *peruvianus* shows that the Beni birds are very close to that race, in fact not sufficiently distinct to be separated, since some of the Beni birds can be exactly matched with skins from the Marañon.

**Anachilus striatus**, sp. nov.

Type from Sta. Ana, Rio Coroico, Dept. La Paz, Bolivia, altitude 2200 feet. No. 120546, A.N.S.P., ♂ adult, collected July 31, 1934, by M. A. Carriker, Jr., original No. 9329.

*Diagnosis*: May be distinguished at a glance from *A. ucayalae* Chapman (only known species of the genus) by the presence of fulvous streaks on the front of the pileum, nape and mantle, and by less well-defined streaks of cinnamon ochraceous on the chest. In *A. ucayalae* the upper and under parts are entirely without indications of paler streaks of any sort.

*Description of type*: Whole pileum, nape, back, scapulars, rump and wing edgings Argus Brown; front and crown sparsely streaked with hair lines of fulvous; nape and mantle broadly streaked with shaft stripes of Cinnamon Buff; upper tail coverts Chestnut; tail between Auburn and Russet, paler below; lores creamy white; a narrow superciliary line from front of eye to nape, cinnamon buff; throat Ochraceous Tawny, paler and more ochraceous towards chin and darker on sides posteriorly and blending into the Antique Brown of the rest of the under parts; chest with rather broad, somewhat obscurely defined, shaft stripes of Ochraceous Buff; flanks and under tail coverts darker brown, about Brussels Brown; under wing coverts the color of throat and wing lining paler, about Cinnamon Buff. The bill is shorter than in *ucayalae*, but the same height at nostril, the wing a little shorter and tail a little longer; the wing formula slightly different, the third, fourth and fifth primaries (from without) the longest and equal in length; the tail is less rounded, the outer rectrix being but 15 mm. shorter than next, while the second is but 4 mm. shorter than third, with the remainder subequal.

*Measurements*: (3 ♂♂ and 1 ♀) length (in flesh) 206, 208, 210, 203 mm.; wing, 100, 100, 99, 95 mm.; tail, 90, 91, 88, 85 mm.; bill, 20.5, 21, 20, 21 mm.; bill (height at nostril) 8, 8, 7.5, 7.5 mm.

*Remarks*: In addition to the type, two males and one female were taken at Sta. Ana. It was not seen at any other collecting station. It is apparently a rare bird, since but four were taken by two collectors in three weeks. Its habits are much like those of *Philydor*, although not usually seen so high up in the trees or as low down as *Automolus* usually is found.

**Sittasomus griseicapillus viridis**, subsp. nov.

Type from Sta. Ana, Rio Coroico, Dept. La Paz, Bolivia, alt. 2200 feet. No. 120634, A.N.S.P., ♂ adult, collected July 31, 1934 by M. A. Carriker, Jr., original No. 9322.

*Diagnosis:* Differs from all other races of *S. griseicapillus* in the uniform olive green color of both upper and under parts. The pileum and mantle are between Citrine Drab and Dark Olive, with a slight russet wash on posterior portion of the mantle; rump and upper tail coverts between Ochraceous Tawny and Antique Brown; wing coverts dusky brown, edged with dull Hazel (very narrowly); narrow edgings of primaries and secondaries dull Hazel; tertials and tail bright Tawny, tail a little darker; whole of under parts (except pale cinnamon rufous under tail coverts) uniform Buffy Olive; under wing coverts and patch at base of inner remiges cream color.

*Remarks:* In addition to the type there are 2 ♂♂ from Teoponte; 1 ♂ from Calabatea; 1 ♀ from Sta. Ana and 1 ♀ from Chatarona. The whole series, with the exception of the Chatarona bird, is very uniform, but the latter is an intergrade between *viridis* and *griseicapillus* of north Argentina and south Bolivia, showing considerable tawny wash on the breast and abdomen, while the upper parts are paler olive.

Compared with a large series of *griseicapillus* from n. Argentina and s. Bolivia, up to Sta. Cruz (in Carnegie Museum). This series, however, is not uniform either, the birds from Palmarito, Rio Quiser, and Samaipata are more yellowish tawny below, like the Chatarona bird. None are as dark green above or below as the upper Beni birds (*viridis*), and are obviously intergrades between typical *griseicapillus* and *viridis*.

***Lepidocolaptes angustirostris immaculatus*, subsp. nov.**

Type from Chatarona (near Reyes), Dept. Beni, Bolivia. No. 120617, A.N.S.P., ♂ adult, collected September 19, 1934 by M. A. Carriker, Jr., original No. 10070.

*Diagnosis:* Differs from all other races of the *angustirostris* group in having the *entire* under parts immaculate white, with just a faint suggestion of creamy wash, and with barely a trace of pale buffy brown on the tips of the longest under tail coverts.

It is nearest to *bivittatus* in the color of the upper parts, but differs from that race in the paler cinnamon rufous of the upper parts (a shade darker than Cinnamon); absence of the broad ochraceous stripes on the upper mantle; paler, more grayish sooty pileum (Clove Brown), with narrower, pure white streaking, and with the entire superciliary stripe white from the lores to the nape; and finally in having the under parts pure white, with no trace of streaking; broad postocular stripe black; auriculars almost entirely white (creamy white in *bivittatus* with slight dusky feather edgings).

*Remarks:* Two ♂♂ (including the type) and 4 ♀♀ taken at Chatarona, between September 15th. and 30th. They were found in the low, scattered trees on the open "pampa". The Chatarona birds were compared with 2 skins of *L. a. coronatus* from Santarem, Brazil, and with 10 skins of *bivittatus* from Sta. Cruz, Bolivia, all in the collection of the Carnegie Museum.



***Dendrocolaptes picumnus australis*, subsp. nov.**

Type from Sta. Ana, Rio Coroico, Dept. La Paz, Bolivia, altitude 2,200 feet. No. 120657, A.N.S.P., ♂ adult, collected July 26, 1934, by M. A. Carriker, Jr., original No. 9291.

*Diagnosis*: Nearest to *D. p. validus* of Peru, but differing as follows: Upper parts darker brown (Brussels Brown), concolorous with pileum (in *validus* the pileum is decidedly blackish towards the bases of the feathers); auriculars largely cinnamon ochraceous (instead of cream color) and with less dusky streaking; mantle with no trace of black spotting or cross bars, and with the black spots on the wing coverts obsolete; no fulvous shaft lines on the rump (shafts chestnut); nearly the whole of the throat creamy ochraceous with much less dusky spotting along the edges of the feathers of the posterior portion; the fulvous shaft stripes on the chest more tapering (not parallel sided) and sharply, but narrowly bordered with black (as in *validus*), but without the black dots on each side of the feathers, except slightly on foreneck; the barring of the lower breast, abdomen and crissum much narrower and broken at the shaft; black bars on under wing coverts much narrower and somewhat broken. The barring of the abdomen scarcely reaches over the breast, while in *validus* it covers the whole of the breast and the lower edge of chest, while the pale stripes of the chest extend further backward in *australis*; hair lines on mantle finer and less conspicuous.

*Remarks*: In addition to the type, two ♀ ♀ were taken at Calabatea, at 4,500 feet. Three skins in the Carnegie Museum from Incachaca, Bolivia belong to this new form. Compared with three topotypes of *validus* from San Juan de Perene, and another male from Puerto Yessup, Dept. Junin, Peru.

***Laniisoma cadwaladeri*, sp. nov.**

Type (and only specimen) from Sta. Ana, Rio Coroico, Dept. La Paz, Bolivia, altitude 2,200 feet. No. 120103, A.N.S.P., ♂ adult, collected July 19, 1934, by M. A. Carriker, Jr., original No. 9148.

*Diagnosis*: Crown and nape black; upper parts dark olive green; under parts deep, rich yellow, with a few black spots on the sides of the chest and breast, and with the flanks sparsely barred with black.

*Description of the type*: Whole pileum, loreal and subocular region and a narrow stripe under the eye, black; nasal plumes reddish orange, forming a short line across the front on each side of the base of the culmen; auriculars, sides of neck, back, rump and upper tail coverts between Ivy and Yew Green; wings blackish, lesser and median coverts the color of the back; greater primary coverts black; primaries narrowly edged with dull olive basally, remainder of remiges with outer webs the color of the back; entire under parts rich yellow, about Lemon Yellow, with shading of Lemon Chrome on the chest and sides of throat, with flanks, vent and crissum nearer to sulphur; a few feathers on the sides of the chest and sides of breast with two or three broken black bars, but with yellow tips; flanks coarsely

barred with black, the yellow interstices wider than the black bars, but with feathers broadly tipped with yellow; under tail coverts with a few black spots on the apical portion; under wing coverts and axillars pale Sulphur, lining of wing whitish on the basal half. The first three primaries are pointed and slightly emarginate, but the fourth is deeply emarginate and narrow on the apical portion (15 mm. wide) and with the tip slightly turned outward (as in *L. elegans*). Length (in flesh), 185 mm.; wing, 102 mm.; tail, 65 mm.; iris brown; bill black, mandible pale bluish horn; feet bluish olive.

*Remarks:* Unfortunately the female of this rare bird was not secured and until it is known there will always remain the question of its relationship to *L. buckleyi* (from the Rio Napo, Ecuador), which is known only from two females and two nestlings. Nevertheless, after carefully analyzing the differences between the sexes in *L. elegans*, and comparing them with *L. buckleyi*, I feel certain that the female of *cadwaladeri* will prove to be quite distinct from *buckleyi*.

In *L. elegans* the male is marked over nearly the whole of the chest and breast with heavy, somewhat concentric, black bars, and the female is heavily lunulated with black over the *entire* under parts. In *buckleyi* the female has the under parts marked by coarser and more numerous blackish markings than in the female of *elegans*. Following this analogy, the male of *buckleyi* should be more heavily marked with black on the under parts than *elegans*, and not almost immaculate yellow as in *cadwaladeri*.

The type, and only specimen secured, or seen, was taken in heavy forest, amongst the undergrowth. Although much time was spent in searching the same locality, no others were seen.

I am very doubtful about this bird being a Cotinga, seeming, in my opinion to have closer affinities with the Pipridae.

***Tityra cayana braziliensis* (Swainson).**

*Psaris braziliensis* Swainson, Anim. Menag., p. 286, Dec., 1837 (Northern Brazil).

One fully adult female of this form was taken at Chatarona, near Reyes, Dept. Beni, Bolivia. I have seen no published record for this species from Bolivia. There is an adult female in the Academy collection taken by Steinbach at Buena Vista, Sta. Cruz, which is intermediate between *cayana* and *braziliensis*, having the upper parts and bill almost typical of *cayana*, while the under parts approach *brazilianus* in the buffy wash and heavy streaking, but there is no streaking on the lower breast, flanks, abdomen and crissum.

The Chatarona bird is typical *braziliensis*, having the whole pileum streaked with black and ashy white; the back washed with brownish (most posteriorly) and the whole of the upper parts, including the upper tail coverts, heavily streaked with black. The entire under parts are heavily

streaked with black and washed with buff, only on the lower flanks, lower belly and crissum the streaks are narrower and more sparse. The bill is "black, leaden blue below, with the base of the maxilla reddish flesh".

***Ochthoeca jelskii boliviana*, subsp. nov.**

Type from Hichuloma, Dept. La Paz, Bolivia, alt. 10,000 feet. No. 119725, A.N.S.P., ♂ adult, collected January 8, 1935 by M. A. Carriker, Jr., original No. 11067.

Similar to *O. j. jelskii* and *O. j. spodionota* of central and north Peru in the yellow front and supra-loral area, long white superciliaries and chestnut wing bars, but differing radically in other characters.

Whole pileum and nape Dusky Neutral Gray; mantle Dark Mouse Gray, becoming more brownish posteriorly and with rump and upper tail coverts dusky Olive Brown; median and greater wing coverts black, broadly tipped with Hazel, slightly darker on the median coverts, forming two sharply marked bars, the posterior one the widest; tertials edged with pale Hazel, and inner secondaries with pale buff; tail uniformly sooty gray; lores black; entire under parts Neutral Gray, paler on middle of throat and abdomen; under tail coverts Pale Mouse Gray; under wing coverts whitish, freckled with dusky. Bill and feet black. Length (in flesh), 136 mm.; wing, 68 mm.; tail, 62 mm.

*Remarks:* In addition to the type, 1 ♀ adult and 1 ♂ immature were taken at same locality. In *spodionota* the mantle is chestnut brown, brighter on the rump and ochraceous on the upper tail coverts, while the under parts are much paler gray, with more white on the abdomen.

In *jelskii* the pileum is dark brown and the back rich chestnut brown, with the rump and upper tail coverts bright chestnut rufous, while the posterior portion of the superciliaries are buffy white, the lower abdomen and crissum buffy cinnamon and flanks darker cinnamon and with the throat and chest dark ashy as in *spodionota*.

It has become again necessary to split up the *O. albidiadema* group as arranged by Dr. Hellmayr. In a previous paper<sup>3</sup> I have separated this group into two parts, viz.: *O. albidiadema* and *O. pulchella*, due to the fact that races of both of these species were found together at Leymebamba, Peru. Now, due to the fact that *O. p. pulchella* was taken together with the above described new race of *jelskii*, it becomes imperative to separate the *pulchella* group, and the races of the two species may be arranged as follows:

*O. p. pulchella* Selater and Salvin (North Bolivia and south Peru).

*O. p. similis* Carriker (Dept. Amazonas, Peru).

*O. j. jelskii* Taczanowski (Northwest Peru and southwest Ecuador).

*O. j. spodionota* Berlepsch and Stolzmann (Depts. Junin to Cuzco, Peru).

*O. j. boliviana* Carriker (North Bolivia).

<sup>3</sup> Proc. Acad. Nat. Sciences Phila., Vol. LXXXV, 1933, p. 23.

**Gubernetes yetapa benii**, subsp. nov.

Type from Chatarona (near Reyes), Dept. Beni, Bolivia, altitude 700 feet. No. 119738, A.N.S.P., ♂ adult, collected September 18, 1934, by M. A. Carriker, Jr., original No. 10042.

*Diagnosis:* Differs from *G. y. yetapa* chiefly in the extent of the chestnut pectoral collar. This area is much reduced on the sides of the neck and sides of head, covering but little more than half of the ear coverts, the upper third being plain slate gray; the collar narrows abruptly towards the middle of the throat, where it is almost broken; the whole post-ocular stripe is narrower; the abdomen with more white, and the lining of the wing pale sulphur instead of white. The length of the wing is the same in the two races, but the tail is longer in the new form, being 285 mm. against about 260 mm.

*Remarks:* In addition to the type, a female was taken at the same place, both breeding birds. Compared with one skin from south Brazil and two from the Argentine Chaco. The character of the pectoral collar is constant, and very pronounced, but the others mentioned above may not all hold good in a series.

**Cnemarchus erythropygius bolivianus**, subsp. nov.

Type from (east of) La Cumbre, Yungas R. R. Dept. La Paz, Bolivia, altitude 13,000 feet. No. 119706, A.N.S.P., ♂ adult, collected January 11, 1935, by M. A. Carriker, Jr., original No. 11095.

*Diagnosis:* Differs from *C. e. erythropygius* of Ecuador as follows: The white of the front extends up to a point over the middle of the eye, while the rest of the pileum is Light Neutral Gray (instead of slate gray), which color extends further backward over the nape; auriculars and sub-orbital region is Neutral Gray (instead of Dark Neutral Gray); rump, upper tail coverts and rectrices paler, Ochraceous Tawny, instead of Cinnamon Rufous; the black tips of the rectrices shorter, (20-21 instead of 32-35 mm.); greater extent of white on throat and foreneck; whole breast more ashy; abdomen and under tail coverts paler rufous, as well as under wing coverts and axillars. The wings and tail are slightly longer, but the amount insignificant.

*Remarks:* In addition to the type an adult female was taken at the same place, probably a pair. A male from Atuen, above Leymebamba, Peru, is intermediate in some characters between the two races, having the head, throat and breast as in *bolivianus*, but the color of the rump and tail like *erythropygius*, also the extent of black on tips of rectrices. This seems to be the first record for the species south of Cuzco, Peru. The Cuzco birds are probably intermediate. Apparently a rare bird everywhere, ranging between 11,000 and 13,000 feet.

Compared with an adequate series from Mt. Pichincha, Ecuador.

**Satrapa icterophrys hellmayri** (Chubb).

*Sisopygus hellmayri* Chubb, Bull. Brit. Orn. Club, XXIX, p. 63, 1907 (Tapacari, Dept. Cochabamba, Bolivia).

I have before me 3 ♂ and 1 ♀ of this form, taken at Chatarona, Dept. Beni, Bolivia, which I have compared with 2 ♂ and 1 ♀ of the same race from Incachaca, Dept. Cochabamba, and with 7 skins of *icterophrys* from Argentina and south Brazil. The Incachaca birds are near enough to the type locality of *hellmayri* to leave no doubt but that they are the same. Unfortunately Chubb had an immature bird for the type of *hellmayri*, with streaks on the breast, which doubtless misled Dr. Hellmayr in his conclusions as to the validity of Chubb's race. The seven skins from the Rio Beni and Cochabamba were collected in January, June, and September, and all are adult birds, some fresher than others, but all in good plumage. *S. hellmayri* may be separated from *icterophrys* by its smaller size, much more slender bill, and by the color of the upper parts, which are much darker green (close to Jade Green) and slightly mottled with dusky centers to the feathers (uniform olive green in *icterophrys*); the whole pileum and nape is Neutral Gray with a slight olive green wash, more pronounced on the front and very slight on the nape. The pale edgings of the wing coverts and secondaries are *not* any whiter than in *icterophrys*, as stated by Chubb, but they are less in extent.

**Myiophobus inornatus** Carriker.

Proc. Acad. Nat. Sci. Phila., Vol. LXXXIII, 1931, p. 461. (Sto. Domingo, Peru.)

It is of interest to note that two more males of this rare little Flycatcher were taken by the author at Sandillani, Bolivia, in December, 1934, which are exactly like the type specimen. The range of the species is apparently continuous from southeast Peru at least as far south as Cochabamba, Bolivia.

**Onychorhynchus coronatus orbignyianus**,<sup>4</sup> subsp. nov.

Type from Sta. Ana, Rio Coroico, Dept. La Paz, Bolivia, alt. 2200 feet. No. 119876, A.N.S.P., ♀ adult, collected July 11, 1934, by M. A. Carriker, Jr., original No. 9005.

*Diagnosis*: Similar to *O. c. castelnaui* of northeast Peru in general coloration, and in having unbarred upper tail coverts, but differs from that form as follows: Bill slightly smaller and paler colored; the basal portion of the tail both above and below and the upper tail coverts very much paler (between Warm Buff and Antimony Yellow); in *castelnaui* the whole tail is nearly uniform in color, being but slightly paler on the basal portion of the outer webs, while in *orbignyianus* the tips of the rectrices are fully as dark as in *castelnaui*, but fade rapidly in color towards the base; the dusky bars on the chest are narrower and much less conspicuous, while the throat is

<sup>4</sup> Named in honor of d'Orbigny, who took the first Bolivian specimen at Yuracares.

more creamy white. Length of wing and tail about the same. In *castelnaui* the maxilla is black and mandible dark brownish, while in *orbignyianus* the maxilla is brownish black and mandible yellowish brown.

*Remarks:* In addition to the type, another ♀ was taken at Sta. Ana, a ♂ and a ♀ at Chiniñiri, Rio Kaka, and a ♂ juv. at Rurrenabaque, Rio Beni. They were compared with two females of *castelnaui* from El Tingo, Rio Huallaga, Peru.

The juvenal male is in very interesting plumage. About six long crest feathers are present, ochraceous in color and barred with black; the colored crest feathers are just appearing, being still in the sheathe, but showing the purple tips; the whole of the upper parts (except the ochraceous upper tail coverts) are pale creamy ochraceous, heavily barred with black, while the whole of the under parts (except the abdomen and crissum) are thickly covered with narrow blackish bars; the bill is very much smaller than in the adults.

***Tolmomyias flaviventris subsimilis***, subsp. nov.

Type from Sta. Ana, Rio Coroico, Dept. La Paz, Bolivia, altitude 2200 feet. No. 119902, A.N.S.P., ♂ adult, collected July 31, 1934 by M. A. Carriker, Jr., original No. 9320.

*Diagnosis:* Nearest to *T. f. flaviventris* of eastern Amazonia (Obidos and Santarem) and much further removed from *T. f. borbae*, whose range lies between the two. Differs from *borbae* as follows: Entire upper parts decidedly more yellowish olive and under parts very much more yellowish, especially on the throat and abdomen, which are almost as yellow as in *aurulentus* of Colombia. Compared with *flaviventris*, we find it closer, but it lacks entirely the fulvous tinge on the throat and chest, while the abdomen is deeper sulphur; the upper parts are about the same, perhaps a little duller olive; the bill is almost the same size and shape but is differently colored. In *flaviventris* the mandible is entirely flesh colored, or yellowish flesh, while in *subsimilis* only the basal portion is flesh, the remainder black or leaden blackish.

*Remarks:* This seems to be the first record of the occurrence of *T. flaviventris* in Bolivia. In addition to the type, 2 ♂ ♂ and 1 ♀ were taken at Sta. Ana and 2 ♂ ♂ and 1 ♀ at Huanay, near the mouth of the Rio Mapiri. I have compared this series with a topotypical series of *T. f. viridiceps* from Peru, from which they are quite distinct; with a large series of *T. f. borbae* from the Rio Puruś and an equally large series of *flaviventris* from Obidos and Santarem, Rio Amazon. Logically, these Bolivian birds should be *borbae*, and it is rather unusual to find them more nearly resembling the lower Amazonian form.

***Todirostrum cinereum intermedium***, subsp. nov.

Type from Chatarona (near Reyes), Dept. Beni, Bolivia. No. 119903, A.N.S.P., ♂ adult, collected September 20, 1934 by M. R. Carriker, original No. 10085.

*Diagnosis:* Intermediate between *T. c. coloreum* of east Bolivia and south Brazil, and *T. c. peruanum* of east Peru, from the Urubamba north. Differs from *coloreum* in the greater extension of the black over the pileum (to back of eye); less amount of yellow on the nasal plumes, and back greenish cinereous (about Slate Olive) instead of olive green, only the rump and upper tail coverts being about Grape Green; tips of rectrices pure white (instead of creamy white) and less in extent; bill shorter and more blunt towards the tip.

From *peruanus* it differs as follows: Nasal plumes tipped with yellow (absent in *peruanus*); less extent of black on top of head; back Slate Olive instead of dark cinereous; rump and upper tail coverts Grape Green instead of uniform cinereous; white tips on rectrices longer.

*Remarks:* The type was the only specimen secured, but it is a fully adult, breeding bird in fresh plumage, and so distinct from the other known races that I do not hesitate in giving it a name.

***Idioptilon rothschildi albopectus*, subsp. nov.**

Type from Sta. Ana, Rio Coroico, Dept. La Paz, Bolivia, altitude 2200 feet. No. 119930, A.N.S.P., ♂ adult, collected August 1, 1934, by M. A. Carriker, Jr., original No. 9344.

*Diagnosis:* Shape and proportionate length of wing and tail the same as in *I. r. rothschildi*, also the shape of the bill, except that it is somewhat thinner and more slender (narrower at the base). The upper parts are slightly more yellowish olive (Serpentine Green), as well as the edging of the rectrices; pileum concolorous with mantle, without dusky centers on feathers; white supra-loral streak the same, also the pale sulphur wing-bars, but the yellow edgings on primaries less conspicuous.

In *rothschildi* the whole of the under parts are more dusky gray (about Smoke Gray), with pale sulphur yellow striations on the throat and breast, with the abdomen and crissum very pale soiled sulphur, while in *albopectus* the under parts are largely whitish, with the breast pale soiled buff, the throat with distinct dusky striations and the breast with fainter ones; the feathers of the throat and lower breast are ashy subterminally, which color shows through somewhat; the abdomen and flanks are pure white, with the vent and crissum pale sulphur; the under wing coverts are Reed Yellow, with the lining of the wing whitish.

Iris straw color; bill black, the tomia flesh; feet leaden blue. Length, males (in flesh), 121 to 129 (average 125 mm.); wing, 51 to 55 (av. 53 mm.); tail, 45 to 54 (av. 49 mm.). Females: Length, 108, 110 mm.; wing, 48, 47 mm.; tail, 40, 38 mm.

*Remarks:* In addition to the type there were taken at Sta. Ana 1 ♂ and 1 ♀; at Huanay, 1 ♀; at Teoponte, 1 ♂; at Rurrenabaque, 2 ♂♂. Compared with a single male of *rothschildi* from French Guiana, in the American Museum of Natural History. The genus has hitherto been known from but a few specimens of *I. rothschildi* from French Guiana, and to find a closely related representative form on the upper Rio Beni, is rather astounding. There can be no doubt of the correct determination of the Bolivian birds.

Mr. Zimmer, of the American Museum of Natural History assisted me in the comparison, and his opinion agreed with my own. The bird is easily recognized by the shape of the bill, resembling very much that of *Oncostoma*, but with the maxilla less decurved.

***Yanacea alpina boliviana***, subsp. nov.

Type from above Kl. 50, Yungas R. R., Dept. La Paz, Bolivia, altitude 13,500 feet. No. 119967, A.N.S.P., ♀ adult, collected January 9, 1935, by M. A. Carriker, Jr., original No. 11092.

*Diagnosis*: Similar to *Y. a. alpina* from the Dept. of Ancash, Peru, but differs from the nominate form as follows: Front of pileum almost entirely black, with but a mere trace of pale feather edgings; the white occipital patch more extensive posteriorly and the crest plumes shorter; white wing bars wider, as well as the white edgings of the tertials; the silvery white edgings of the throat feathers more conspicuous and the abdomen pure white (not pale sulphur); under wing coverts pure white instead of buffy white. Size the same.

*Remarks*: The taking of a closely related, representative form of this monotypic genus, so far from the type locality of the genotype is quite a notable event. But one pair was seen, both of which were shot, but the male could not be found.

***Tyrannulus elatus benii***, subsp. nov.

Type from Chatarona (near Reyes), Dept. Beni, Bolivia. No. 120066, A.N.S.P., ♂ adult, collected September 24, 1934, by M. A. Carriker, Jr., original No. 10177.

*Diagnosis*: In some respects this race resembles *T. e. elatus* and in others, *T. e. panamensis*, differing from both, but closer to *panamensis*. The throat is even whiter than in *panamensis*, while the abdomen and crissum are duller, more olive yellow than either; the coronal spot is deep, rich yellow and the amount of black on median line of pileum is about as in *panamensis*; the sides of the head and auriculars are paler ashy, with more white around the eye, while the pale ashy superciliaries are wider and more conspicuous than in the other races; the wing bands are pale sulphur (not white) and the edgings of the secondaries deeper sulphur; the wings are blacker; the under parts from the throat to the crissum are almost uniform grayish, olive yellow, only a small spot in the center of the abdomen being pure yellow, while in *panamensis* the whole of the lower breast, abdomen and flanks are clear sulphur yellow.

*Remarks*: A single female was taken, also at Chatarona, in addition to the type. Both birds are in full, fresh plumage, the type with gonads slightly enlarged. The length of the wing is about as in *panamensis*, but the tail is shorter. Wing (type), 55 mm.; tail, 44 mm.; female, wing, 51 mm.; tail, 43 mm.



**Thryothorus leucotis guarayanus** (Lafresnaye and d'Orbigny).

*Troglodytes guarayana* Lafresnaye and d'Orbigny, Syn. Av., 1, in Mag. Zool. 7, cl. 2, p. 26, 1837.

A common species at Chatarona. Dr. Hellmayr has made *guarayanus* a distinct species (Birds of the Americas, vol. XIII, p. 158), for what reason I cannot understand, unless he confused it with *T. leucotis rufiventris*. He compares *guarayanus* with *rufiventris* (of which we have skins from Matto Grosso) instead of *T. l. peruanus*, its nearest relative.

His descriptions and comparisons are excellent and I cannot help believing that he meant to make *rufiventris* a distinct species and *guarayanus* a race of *T. leucotis*, of which it obviously is. At all events, that is what should be done, since the long, differently shaped bill, and large size of *rufiventris*, certainly entitle it to specific rank.

**Henicorhina leucophrys boliviana** Todd.

Proc. Biol. Soc. Wash., 45, p. 10, 1932. (Incahaca, Dept. Cochabamba, Bolivia.)

We have a series of five skins of this form taken at Calabatea and Sandillani, Dept. La Paz., which have been compared with Cochabamba material and found to be exactly the same. Compared with a large series of *H. l. leucophrys*, including two topotypes from Huacapistana, Peru, but no specimens seen from the region between the Depts. of Junin and Puno, Peru. All birds from Junin north are obviously *leucophrys*, but those from Oconeque, Dept. Puno are close to the Bolivian race, though not typical, showing a slight tendency towards the northern form.

It is a poorly differentiated race at best, as Dr. Hellmayr has pointed out. The black bars on the abdomen are absent in all five of the skins from Calabatea and Sandillani, but present in three from Oconeque, but not in the remainder of the Peruvian series. *H. l. boliviana* may be distinguished by the greater amount of white on the sides of the head, darker, slate-gray breast, duller brown flanks, and by more or less blackish edgings on the feathers of the throat.

**Microcerculus marginatus bolivianus**, subsp. nov.

Type from Sta. Ana, Rio Coroico, Dept. La Paz, Bolivia, altitude 2200 feet. No. 121219, A.N.S.P., ♂ adult, collected July 26, 1934, by M. A. Carriker, Jr., original No. 9287.

*Diagnosis:* Nearest to *M. m. marginatus*, from which it differs in the much darker coloration of the under parts and in having the white area below almost immaculate; by the presence on the sides of the lower breast and upper abdomen (around the posterior border of the white area) a considerable blackish area, freckled with white; the flanks are darker brown (Mummy Brown), with no rufescent tinge and with less amount of the broken blackish barring as in *marginatus*.

*Remarks:* A series of seven skins from Peru (Huacamayo and La Pampa, Dept. Puno; Perene and Puerto Yessup, Dept. Junin; Moyobamba,

Dept. Amazonas) are all very uniform. In addition to the type of *bolivianus*, two other males were taken at Sta. Ana and a female at Teoponte. These four skins are also very uniform. But one of these four skins shows any dusky feather edging on the breast, and but just a trace on the posterior portion. Not one of the Peruvian series shows heavy dusky markings in the white area, while two skins have a minimum amount, about like the one Bolivian skin (these two are from south Peru). All of the Peruvian series have at least the basal half of the mandible flesh color, while the three males from Bolivia have the entire bill blackish (in life), while in the single female the mandible is entirely flesh color. All are apparently adult, in fresh plumage, but none showed enlargement of the gonads.

***Diglossa brunneiventris*** Lafresnaye.

Rev. Zool., 1846, p. 318 (Peru).

A common bird in the upper Unduavi valley, also taken sparingly near Calocoto, below La Paz. When Mr. Zimmer reviewed this group he made *brunneiventris* a subspecies of *carbonaria*. It seems to me that this treatment only adds confusion to the situation and adds nothing to our knowledge of the relationship of the two birds. *D. carbonaria* and *brunneiventris* are found together over a considerable area in northern Bolivia (both were taken at Calocoto) and there is no indication of intergradation between the two. The color pattern in the two species is so different on the under parts that I fail to see how it could be regarded as anything but specific, especially since there are no intermediate forms.

***Orochelidon murina cyanodorsalis***, subsp. nov.

Type from Hichuloma, Yungas Railway, Dept. La Paz, Bolivia, altitude 10,700 feet. No. 121237, A.N.S.P., ♂ adult, collected December 29, 1934, by M. A. Carriker, Jr., original No. 10946.

*Diagnosis:* Somewhat similar to *O. m. murina* of Ecuador and Peru, but differs from that form in having the entire upper parts deep, rich, purplish violet (shining Dusky Violet Blue), while in *murina* this area is shining Lily Green; the under tail coverts are blacker and with broad tips of the blue of back; under parts are more grayish sooty (about Mouse Gray).

*Remarks:* Two birds from Limbani, south Peru, are somewhat intermediate between the two races, having the upper parts more greenish, and the under parts darker, as in the Bolivian birds. Compared with eight skins of *murina* from Ecuador and six from Peru.

***Chlorothraupis olivacea frenata*** Berlepsch.

*Chlorothraupis frenata* Berlepsch, Proc. IV Intern. Orn. Congr. London, 1905, p. 349, 1907 (Marcapata, Peru).

Two ♂♂ and four ♀♀ from Chiniñiri, Rio Beni, compared with eleven topotypical skins from southeast Peru; with six skins of *C. olivacea* from

the Chocó, Colombia; with three skins of *C. carmioli* from Nicaragua and with one skin of *C. stolzmanni* from west Ecuador.

The Bolivian birds are exactly like the La Pampa series from southeast Peru. There can be little question of the specific distinction of *stolzmanni*, but it seems best to unite the other three forms under *olivacea* (the oldest name), so that *carmioli* and *frenata* become subspecies of that form.

***Sporophila melanocephala pallida***, subsp. nov.

Type from Chatarona (near Reyes), Dept. Beni, Bolivia. No. 119041, A.N.S.P., ♂ adult, collected September 20, 1934 by M. A. Carriker, Jr., original No. 10092.

*Diagnosis:* Most nearly related to *S. m. ochrascens* of south Brazil and Bolivian Chaco, but much paler on under parts, sides of neck and nuchal collar, which is very narrow and almost broken medially and with less black and more ashy gray on upper parts.

*Description of type:* Pileum, nape and sides of head uniform black; supraloral and sub-ocular spot white (instead of ochraceous); broad band on sides of neck and narrow nuchal collar Light Buff; mantle black, with scapulars and middle back close to Pale Neutral Gray; lower back and rump more buffy gray, with a broad band of Cream Buff across the middle of the rump; upper tail coverts and tail black, the former with slight grayish edgings and the latter with narrow buffy gray tips (above); throat white; broad pectoral band black, wider on the sides of the chest and narrower in the middle; rest of under parts uniform Warm Buff, more Cinnamon Buff on flanks; rectrices (below) blackish, with broad tips of Storm Gray; under wing coverts and bases of remiges white; lesser wing coverts Cream, the inner median series tipped with same and inner greater coverts tipped and slightly edged with grayish white; large speculum at base of primaries white (not ochraceous). Female Light Brownish Olive on the upper parts, a little darker on the wings, lower back and rump; tail blackish, edged with color of the back; sides of head and sides of neck Isabella Color; throat and chest between Cinnamon Buff and Clay Color; sides of breast and flanks darker, between Buckthorn and Dresden Brown; lower breast, abdomen and crissum Cream Buff; under wing coverts and bases of quills white.

*Remarks:* I have compared skins of *S. melanocephalus* from Matto Grosso, Rio Parana, Argentine Chaco and Puerto Peñasco, Paraguay; also from Palmarito, Rio San Julian, Bolivia. The series of skins from the above mentioned localities should contain both *S. m. melanocephala* and *S. m. ochrascens*, but I can find little or no constant differences to separate the two. I am not at all certain that *ochrascens* is a tenable race. In addition to the type of *pallida*, there are two adult males, two immature males and 1 adult female, all from Chatarona. The new form is easily distinguished from *melanocephala* and *ochrascens* by its much paler coloration, white lores, throat and wing speculum, and decidedly gray (instead of buffy brown) color of area surrounding mantle.

**Catamenia analis subinsignis**, subsp. nov.

Type from Sandillani, Dept. La Paz, Bolivia, altitude 6800 feet. No. 119051, A.N.S.P., ♂ adult, collected December 11, 1934, by M. A. Carriker, Jr., original No. 10685.

*Diagnosis:* The darkest of all the races of *analis* and most nearly related to *C. a. insignis* Zimmer, of the upper Marañon Valley of Peru, agreeing with that form in the absence of wing speculum, having merely the outer edges of the third, fourth and fifth primaries white at their bases, and mostly concealed by the greater primary coverts.

The upper parts are darker than in *insignis* (Slate Gray) and the under parts uniformly Deep Gull Gray, with only a very small spot of soiled white at the vent, and with the white area on the outer rectrices shorter than *insignis* by 5 mm.

*Remarks:* In addition to the type, two other males and one female were taken at Sandillani, one immature female at Hichuloma and 1 adult male and two adult females at Calocoto, a few miles below La Paz.

It differs from *analis* in the much darker upper parts and uniform dark gray under parts (*analis* having the whole abdomen whitish) and in the absence of the white speculum, the basal portion of the whole feather being white in *analis*. Compared with 5 ♂♂ of *analis*, two from La Paz, two from Incachaca, Cochabamba, and one from Chile; with a large series of topotypical skins of *analoides* from the west coast of Peru and with 3 ♂♂ and 1 ♀ of *insignis* from the upper Marañon, Peru.

The two skins listed in the "Catalogue of Birds in the British Museum" from Sorata and placed under *analoides* (without wing speculum) doubtless belong to this new form, *subinsignis*. The question now arises as to where d'Orbigny's type of *analis* came from. The locality given is the "Bolivian Cordilleras", which is very indefinite. The two males in the Academy collection labelled La Paz, and collected by Prof. Orton, may not have come from La Paz at all, or else the presence of typical *subinsignis* in the valley 12 miles below that city would complicate matters very much.

It is quite possible that true *analis* comes from the Pacific slope of the higher Bolivian Andes and extends southward into the higher parts of Cochabamba, while *subinsignis* replaces it on the eastern slopes of the eastern cordillera, for La Paz is situated at the upper end of a valley opening eastward through the eastern cordillera.

**Pheucticus aureiventris aureiventris** (d'Orbigny and Lafresnaye).

*Pitylus aureiventris* d'Orbigny and Lafresnaye, Syn. Av., in Mag. de Zool., 1837, p. 84. (Sicasica, Bolivia.)

Three ♂♂ and 2 ♀♀ from Sta. Ana and Teoponte, upper Beni, Bolivia, compared with three skins from Oconeque, south Peru and three from Matto Grosso, Brazil. The males from Matto Grosso, while apparently adult,

have the rump feathers narrowly edged with olive, as in the females, but to a lesser extent, while the female is nearly immaculate yellow below. The females from Sta. Ana, Bolivia have numerous black streaks on the throat and chest. The amount of black spotting on the sides and flanks in the males appears to be merely an individual character, irrespective of locality. The Bolivian males have the upper tail coverts almost uniform black, with little or no white barring on the outer feathers, but *all* show a trace of yellow mixed in with the black of the rump. One male from Oconeque, south Peru, has several narrow white bars on the lateral upper tail coverts and more yellow on the rump, while another male has the lateral white bars more than twice as broad, also with traces of yellow in the rump. Two males of *P. terminalis* from Leymebamba, Peru have the wide white bars on the lateral upper tail coverts and in addition large subterminal, white spots on the longer coverts, with a scattering of yellow on the rump.

In view of these facts it seems clear that *P. aureiventris* and *uropygialis* (of Colombia and Ecuador) are conspecific, being connected by *terminalis*, and all three forms should be classed as races of *P. aureiventris* of d'Orbigny and Lafresnaye, the older name.

DESCRIPTIONS OF NEW BIRDS FROM PERU AND ECUADOR, WITH  
CRITICAL NOTES ON OTHER LITTLE-KNOWN SPECIES

BY M. A. CARRIKER, JR.

While working up the large collection of birds made by the author in Bolivia in 1934-5 for this Academy, it has been possible to make direct comparisons of Peruvian material with topotypical or typical Bolivian species or races, with the result that quite a number of Peruvian forms, hitherto considered the same as Bolivian races prove to be separable, and these new forms are described below, together with a new race of *Catharus dryas* from west Ecuador, which has hitherto been considered inseparable from the typical form found in Guatemala. Thanks to Mr. Rodolphe M. de Schauensee of the Academy staff, we have been able to secure two good skins of typical *dryas* from Guatemala, and comparison of the west Ecuador specimens with these proves them to be quite distinct.

Thanks are due to the Carnegie Museum, the U. S. National Museum, and the American Museum of Natural History, for the privilege of examining material in their collections pertinent to the specimens now under discussion. Special thanks are due to Mr. W. E. C. Todd of the Carnegie Museum, to Dr. Herbert Friedmann and Mr. J. H. Riley of the U. S. National Museum, and to Mr. J. T. Zimmer of the American Museum, for their assistance and criticisms.

The names of all colors, used in the descriptions, which are capitalized are taken by direct comparison from Ridgway's "Color Standards and Nomenclature", 1912.

***Oreophilus ruficollis pallidus*, subsp. nov.**

Type from San Jose (near Pimentel), Dept. Lambayeque, Peru, No. 118112, A.N.S.P., ♂ adult, collected May 9, 1933, by M. A. Carriker, Jr., original No. 6212.

*Diagnosis:* Similar to *O. r. ruficollis* of the highlands of Bolivia, Chile and Argentina, but very much paler throughout, except the throat which is deeper rufous, and very much smaller in size, with especially slender tarsi and toes.

*Description of type:* Pileum pale ashy brown (instead of dark cinnamon brown; superciliary stripe paler, pale cream color instead of fulvous; hind neck and upper mantle Smoke Gray; back and wings very much paler, the sandy buff feather edgings being replaced by Cartridge Buff which in some places deepens into Cream Buff; median black streaks wide and sharply defined and edged on each side by Smoke Gray; shorter upper tail coverts

Smoke Gray, with slight buffy tips, the longer ones Clay Color; tail about the same as in *ruficollis*, but some paler throughout; throat deeper rufous than in *ruficollis*, about pale Hazel; chest about Pale Smoke Gray, with a slight creamy wash; lower breast pale cream color, with abdomen and under tail coverts almost white; tips of rectrices below almost white (not ochraceous).

*Measurements:*

*O. r. ruficollis*, 3 ♂♂ and 4 ♀♀; Length (in flesh), 267 to 293 mm. (av. 278); wing, 163 to 174 mm. (av. 170); tail, 81 to 91 mm. (av. 87); tarsi, 48 to 51 mm. (av. 49.5).

*O. r. pallidus*, 2 ♂♂ and 1 ♀ (including the type); Length, 252 to 260 mm. (av. 256); wing, 145 to 151 mm. (av. 147.5); tail, 73 to 82 mm. (av. 77); tarsi, 45 to 48 mm. (av. 47).

*Remarks:* The series of seven skins of *O. r. ruficollis* collected at Desaguadero, Peru, 12,800 feet, on May 4, 1931, were compared with a good series of presumably typical skins of *ruficollis* from Argentina, while the three skins of *pallidus* were taken on May 9th, so that there can be no question of seasonal difference. The birds are strikingly different both in color and in size. The measurements of the tarsi fail to properly convey the actual difference, which is more in circumference than in length. They were taken not far from the ocean on the desert and were part of a small flock. It is very probable that this small pale race ranges along the whole coast of Peru, and perhaps the single specimen taken by Whitely at Islay (=Mollendo) belongs to this new form, typical *ruficollis* being confined to the high altitudes of south Peru, Bolivia, and Chile, descending to lower levels further south.

***Phaethornis syrmatophorus huallagae*, subsp. nov.**

Type from Rio Jelashte, Dept. San Martin, Peru, altitude 4500 feet, No. 115513, A.N.S.P., ♂ adult, collected August 11, 1932 by M. A. Carriker, Jr., original No. 5744.

*Diagnosis:* Nearest to *P. s. syrmatophorus* of Ecuador and agreeing with that race in the short, white median throat stripe, but differing in darker bronze-green upper parts and darker and richer cinnamon rufous rump, upper tail coverts and under parts.

The pale cinnamon buff feather edging of the upper parts less conspicuous; the rump and upper tail coverts nearest to Cinnamon (instead of Cinnamon Buff); the front portion of the malar stripe whitish (not Cinnamon Buff), the posterior half Cinnamon Buff; postocular streak and ear coverts as in *syrmatophorus*; the region between the malar and median throat stripes blackish, with very faint pale tips to feathers, this color extending backward nearly to the end of the median throat stripe; rest of under parts much more richly colored, the breast about Clay Color and the abdomen and under tail coverts nearly Cinnamon (instead of uniformly Warm Buff); tips of all the rectrices except middle pair Ochraceous-Tawny (instead of Cinnamon-Buff); the blackish portion of the median pair of

rectrices (between the greenish base and white tips) is more extensive and deeper black, this color extending apically for some distance along the outer edge of both webs; the remiges are darker, deep purplish black.

*Remarks:* In addition to the type, another ♂ and an adult ♀ were taken at the same locality. The female differs but slightly from the ♂, there being a little more white on the median line of the breast and abdomen, while the lower foreneck is more nearly Cinnamon than in the ♂. Compared with three skins of *syrrhaptes* from San Domingo, Colorado, Ecuador.

***Phaethornis porcellae*, sp. nov.**

Type from Porculla Pass, Dept. Lambayeque, Peru, altitude 5,200 feet. No. 118211, A.N.S.P., ♀ adult, collected May 18, 1933, by M. A. Carriker, Jr., original No. 6264.

*Description of type:* Pileum Chaetura Drab, slightly washed with bronze green; back shining Andover Green; rump and upper tail coverts Hazel, the latter with a slight greenish shaft stripe on the basal portion; tail black, with the tips of all the rectrices white, this color extending backward slightly on the outer web of the three outer pairs, and with the tips of the outer pair ochraceous on the inner web; rectrices evenly graduated in length, the longest pair 8 mm. longer than the next pair and scarcely exceeding them by more than the difference between the succeeding pairs; upper throat about Pallid Mouse Gray, blending into Cinnamon Buff on lower throat, breast, and abdomen, a little more warmly colored on the abdomen and under tail coverts; a broad, white, post-ocular stripe reaching to the nape, with a broader black stripe running backward from behind the eye, through the auriculars, to the nape. Bill black above, with basal half of mandible lemon yellow; feet flesh.

Length (in flesh), 119 mm.; wing, 40 mm.; tail, 46 mm. (shortest rectrices 23 mm.).

*Remarks:* Another adult female was taken at the same locality on May 21st. This seems to be the first record of the taking of any species of *Phaethornis* on the western slopes of the western cordillera of the Andes in Peru. There seems to be no other species closely resembling it, the nearest one to it geographically being *P. strigularis subrufescens* Chapman, of western Ecuador, which is a very much smaller bird and very differently colored. This species is about intermediate in size between the smaller (*Pygmornis*) section of the genus and the larger forms (*Phaethornis*). After a careful examination of many species of this genus I can see no necessity for retaining *Pygmornis* for the smaller forms.

***Hylocharis josephinae peruviana*, subsp. nov.**

Type from Moyobamba, Dept. San Martin, Peru, altitude 3500 feet. No. 118333, A.N.S.P., ♂ adult, collected October 15, 1933 by M. A. Carriker, Jr., original No. 8078.



*Diagnosis:* Resembling *H. j. josephinae* of Bolivia, but differing as follows: Nape washed with blue (blue of crown not sharply defined); the coppery bronze of upper tail coverts not extending up over the rump (as in *josephinae*); throat and chest with less bluish wash, more golden bronze; under tail coverts much paler and duller coppery bronze, broadly edged with whitish (instead of deep coppery bronze, narrowly edged with whitish).

A ♀ taken at Perene, Dept. Junin, on December 25, 1929, apparently belongs to this form, and differs from the ♀ of *josephinae* in having the upper parts darker green (less yellowish bronze); the bill longer; the under parts with much fewer green discs on the throat and sides of body; in having the under tail coverts dull coppery bronze, broadly fringed with soiled white (instead of almost wholly whitish); the tail below has the subterminal area darker coppery bronze, and with the pale tips shorter and darker ashy.

*Remarks:* I do not consider *H. josephinae* to be conspecific with *H. oenone*, for the reason that the type of *H. j. peruviana* (which is clearly conspecific with *josephinae*) comes from Moyobamba, only a few miles from Rioja, where *intermedia* has been taken, while I have a fine adult ♂ of that race from Saposoa, below Moyobamba, near the Rio Huallaga.

In other words *peruviana* is the northern representative of *josephinae*, and *intermedia* is the southern representative of *oenone*, while the ranges of *peruviana* and *intermedia* overlap in the region of Moyobamba. Mr. Zimmer is doubtful of the validity of *longirostris*, and after a careful examination of a considerable series of specimens, I agree with him, but it seems fairly evident that *intermedia* is a perfectly good race. The Saposoa ♂ has the chin glittering blue, this color extending backward under the eye to the ear coverts which are green, and also slightly down the median line of the upper throat, about 8 mm. from the base of the bill; also, the breast is decidedly more blue-green than in *oenone*, and the upper tail coverts less reddish coppery, while the back is also decidedly blue green, instead of bronze.

***Helianthus amethysticollis laticlavus* Salvin.**

*Helianthus laticlavus* Salvin, Cat. Birds Brit. Mus., XVI, 1892, p. 160, pl. V, fig. 1 (Ecuador).

A fully adult male in fresh plumage, taken at Huacapistana, Dept. Junin, Peru, 8,000 feet, on March 29, 1930, is without doubt this species, agreeing exactly with Salvin's description. It is clearly the connecting link between *H. clarissae* of Colombia and *H. amethysticollis* of Bolivia. The pectoral band is wide, as in *amethysticollis*, but very pale creamy white, not pure white as in *clarissae*, or fulvous as in *amethysticollis*; there is more buff on the median line of the breast and abdomen than in the northern bird, but much less than in the Bolivian race; the under tail coverts are intermediate in color, while the rectrices are steel blue as in *amethysticollis*, not dead black as in *clarissae*. The throat and upper parts are exactly the same in all three races. It is thus evident that the three birds known as *Helianthus*

*clarissae*, *H. laticlavus* and *H. amethysticollis* are conspecific, and must bear the older name of d'Orbigny and Lafresnaye, becoming as follows:

*Helianthus amethysticollis amethysticollis* (d'Orb. & Lafr). (Southern Peru and Bolivia).

*H. a. laticlavus* Salvin. (Cent. Peru north into Ecuador).

*H. a. clarissae* (Longuemare). (Colombia and W. Venezuela).

It is possible that *H. strophianus* (Gould) also belongs with this group, but I rather doubt it, since the tail always seems to be dark steel blue on all of the rectrices (not bronze green on the median pair) and the median rectrices are considerably shorter than the lateral, which is not the case in the *amethysticollis* group.

***Metallura smaragdinicollis septentrionalis* Hartert.**

*Metallura smaragdinicollis septentrionalis* Hartert, Novit. Zool., VI, 1899, p. 73 (Cajabamba, Peru).

While recently working over material in this genus from Bolivia, I carefully reviewed all the Peruvian skins in the Academy Collection, and the following facts regarding the ranges of *smaragdinicollis* and *septentrionalis* at once became apparent.

The Bolivian series from Hichuloma (=Unduavi) may be taken as topotypes of *smaragdinicollis*, and this form extends northward into Peru along the eastern slopes of the Eastern Andes as far as the Dept. of Amazonas, crossing over to the west slopes of the eastern Cordillera at Atuen, Leymebamba, and Levanto. It is replaced in the upper Marañon Valley (both slopes) by *septentrionalis*, which extends over the western Cordillera as far north as the Dept. of Ancash, or perhaps further. In northwest Peru (at El Tambo) it is again replaced by *M. tyrianthina quitensis* of Ecuador. *M. theresae* Simon (equals *M. rubiginosa* (Cory)), ranges on the western slopes of the eastern Cordillera at least from Patas, Dept. Libertad, to Atuen, above Leymebamba in the Dept. of Amazonas. This is quite a different species and not closely related to the *smaragdinicollis* group.

***Metallura aeneocauda* (Gould).**

*Trochilus aeneocauda* Gould, P. Z. S., London, 1846, p. 87 (Bolivia).

No specified locality was given for the type of this species, nor has any locality been designated that I am aware of. It is an abundant bird just at timber-line around Unduavi, Prov. de La Paz, a locality easy of access in the old days, and I would suggest that this place be designated as the type locality.

***Chalcostigma olivacea* (Lawrence).**

*Rhamphomicrum olivaceus* Lawrence, Ann. Lyc. N. H., N. Y., VIII, 1867, p. 44 (La Paz, Bolivia).

As far as I am aware, the type specimen is the only Bolivian record for this species, all other recorded skins having come from central Peru in the

Puna zone of the Dept. of Junin. It is possible that these Peruvian skins were never actually compared with the type, for they prove to be quite distinct. In the collection made for this Academy in Bolivia during 1934-5 by myself, there are three skins of this rare species, one ♂ and two ♀♀, from La Cumbre, Prov. de La Paz, at 14000 to 15000 feet, at a distance of about 28 kilometers from La Paz, and are therefore topotypes of Lawrence's species. Comparing these topotypes with two ♂♂ and one ♀ from Aricoma, Dept. Puno and three ♀♀ from La Galera, Dept. Junin, all from above 15000 feet, we find that the three Junin birds are quite distinct and represent an undescribed subspecies of *olivacea* which is described below.

***Chalcostigma olivacea pallens*, subsp. nov.**

Type from La Galera, Dept. Junin, Peru, altitude 15,000 feet. No. 92763, A.N.S.P., ♀ adult, collected April 10, 1930 by M. A. Carriker, Jr., original No. 1572.

*Diagnosis*: Similar in general appearance to *C. o. olivacea*, but much smaller and paler throughout. The upper parts are dull grayish olive bronze, with the tail dull bronzy olive brown (not bronze green); the under parts are pale buffy brown, the feathers narrowly margined with paler buff (in *olivacea* the under parts are dark sooty brown, with a very faint sheen of bronze in certain lights); the under tail coverts are much paler olive brown, with the edgings buffy white and broader than in *olivacea*, in which they are dark sooty, edged with creamy ochraceous.

*Measurements*:

*C. o. olivacea*: (topotypes) One ♂; length (in flesh), 148 mm.; wing, 89 mm.; tail, 71 mm.; bill, 16 mm. Two ♀♀, length, 134, 140 mm.; wing, 80, 82 mm.; tail, 61, 64 mm.; bill, 15, 14.5 mm. Two ♂♂ from Aricoma Pass: Length, 150, 151 mm.; wing, 92 mm.; tail, 74, 70 mm.; bill, 15, 14.5 mm. One ♀ from Aricoma Pass: Length, 142 mm.; wing, 81 mm.; tail, 66 mm.; bill, 14 mm.

*C. o. pallens*: Two ♀♀ (including type); length, 124, 119 mm.; wing, 78, 76 mm.; tail, 54, 55 mm.; bill, 11.5 mm. One ♂ immature (La Galera); length, 125 mm.; wing, 75 mm.; tail, 57 mm., bill, 13 mm.

The immature ♂ has a few glittering feathers on the throat, which correspond in color with those from La Paz. The three birds from Aricoma Pass, south Peru, are exactly like the topotypes from La Paz.

Apparently this is a rare bird and rarely ever taken below 14,000 feet.

***Chalcostigma ruficeps aureofastigatum* Hartert.**

Novit. Zool., VI, 1899, p. 74 (Loja, Ecuador).

In our Bolivian and Peruvian collections are the following skins of *C. r. ruficeps* and *C. r. aureofastigatum*. Sandillani, Bolivia, 2 ♂♂; Oconeque, south Peru, 2 ♂♂ Huacapistana, Peru, 2 ♂♂ and Leymebamba, Peru, 1 ♂.

The two Bolivian birds may be considered topotypes, since I now designate Sandillani as the type locality (type labelled merely "Bolivia").

The two skins from Oconeque are the same except that the chest is paler rufous and the abdomen slightly paler (all Peruvian birds have the paler rufous chest). The Huacapistana males are about intermediate between *ruficeps* and *aureofastigatum* as to color of gorget and under tail coverts. The Leymebamba bird, while taken at some distance from the type locality of *aureofastigatum*, seems to be about typical in coloration.

The race is not a strongly marked one, the differences seeming to consist of the following: The tip of the gorget more abruptly and brighter golden green and the under tail coverts pale buff instead of fulvous, and the tail, below, more coppery bronze (less greenish bronze); the upper parts are slightly more golden bronze and the front of the pileum has more of the delicate lilac sheen, while the abdomen is slightly paler.

**Ramphomicron microrhynchum albiventris**, subsp. nov.

Type from Huacapistana, Dept. Junin, Peru, altitude 8,000 feet. No. 92772, A.N.S.P., ♂ adult, collected March 29, 1930, by M. A. Carriker, Jr., original No. 1462.

*Diagnosis:* Similar to *R. m. microrhynchum*, of Colombia, on the upper parts, but different below. The gorget with less golden orange tinge, more yellowish green; under parts purer green, less golden bronze, while the tawny wash of the abdomen, vent and under tail coverts of Colombian birds is replaced by slightly soiled white. The under tail coverts are white, with large purplish-black centers to the feathers, instead of tawny ochraceous. In the female the difference in color of the abdomen and crissum is more pronounced, in *microrhynchum* those parts being tawny cinnamon, while in *albiventris* they are soiled white.

*Remarks:* Five fully adult males, one nearly adult, and one female, were taken at the same place on the mountainside above Huacapistana. I believe this to be the first record for the species in Peru.

Compared with three ♂♂ from Ramirez, Santander, and Saneudo, Caldas, Colombia, and with three ♀♀ from the same localities.

**Colaptes rupicola stolzmanni** Taczanowski.

*Colaptes stolzmanni* Tacz., P.Z.S., 1880, p. 209 (Cutervo, Peru).

Comparison of a series of nine skins of *Colaptes rupicola* from northern Peru, taken at various localities in the eastern and western cordilleras reveals the interesting fact that two well-defined races are present. Birds from the eastern cordillera, in the Departamento de Amazonas are very different from those found in Libertad and Cajamarca, the former being very much more richly colored below, with the bill averaging about 8 mm. longer and the wing from 10 to 15 mm. longer.

The type of *C. r. cinereicapillus* Reichenbach, came from Huayabamba, Departamento de Amazonas, and doubtless was secured in the higher part

of the range, up towards Molinopampa, for the bird is not found below timber-line. His name would therefore be applicable to the large, richly colored form from Amazonas.

The type of *C. stolzmanni* Taczanowski, came from Cutervo, in the Departamento de Cajamarca, where the smaller, paler colored birds are found, and his name thus becomes available for that race.

***Thamnomanes caesius intermedius*, subsp. nov.**

Type from Puerto Yessup, Dept. Junin, Peru. No. 92126, A.N.S.P., ♀ adult, collected January 20, 1930, by M. A. Carriker, Jr., original No. 783.

Nearest to *T. c. schistogynus* of Bolivia and south Peru, but decidedly darker throughout in both sexes and with the bill averaging one mm. wider at the base. The upper parts are Dark Neutral Gray in the male (Slate Color in *schistogynus*); under parts Deep Neutral Gray (Slate Gray in *schistogynus*); the females are about the same color above as the males of each race, while in *intermedius* the throat and foreneck is Slate Gray, of less extent posteriorly and quite sharply defined from the Hazel of lower breast and abdomen. In *schistogynus* the female has the throat and chest Dull Gull Gray, blending quite gradually into the Ochraceous Tawny of the breast and abdomen. One ♀ from Puerto Yessup and two from Bolivia have the under tail coverts approaching the color of the abdomen, the remainder have them gray.

*Remarks:* It is with much hesitation that I add another race to this group which is already badly involved in northeast Peru, as Mr. Zimmer has pointed out. That fact that Mr. Zimmer saw no specimens from the region of Puerto Yessup, and the fact that my large series from Bolivia and south Peru are so uniform and so different from the Yessup series, leaves me no alternative.

*Material examined:* 6 ♂♂ and 4 ♀♀ from various localities on the upper Rio Beni, Bolivia and 3 ♂♂ and 4 ♀♀ from La Pampa and Huacamay, southeast Peru (*T. c. schistogynus*); 4 ♂♂ and 4 ♀♀ from Puerto Yessup, Rio Pichis, Dept. Junin, Peru (*T. c. intermedius*).

The fact that there exists in east central Peru this distinct race, may throw some additional light on the confused condition of the known specimens from northeast Peru, which, however, I am not at present able to discuss.

***Neorhopias rufa peruviana*, subsp. nov.**

Type from Saposoa, Dept. San Martin, Peru. No. 117400, A.N.S.P., ♀ adult, collected November 4, 1933 by M. A. Carriker, Jr., original No. 8277.

*Diagnosis:* Intermediate between *N. r. rufa* and *N. rufa rufatra*, having the heavy streaking on the under parts as in *rufa* and with the pale rufous upper parts and grayish brown basal portion of the rectrices as in *rufatra*, but differing from both in having the primaries pale brown, with wide edgings of buff and with the greater primary wing coverts entirely brown,

with the rest of the greater and all of the median coverts dusky brown, broadly margined with rufous brown, and only the lesser coverts black; the white spots on the tips of the wing coverts are smaller and the white tips of the rectrices but half the width of those in *rufa* and *rufatra*; the tibiae are brown, mixed with white, but without black; the broad black streaks of the under parts stop at the lower breast (as in *rufatra*), but the ground color is decidedly ashy, not white, while the lower sides and abdomen are slightly washed with dully ashy; the pileum is uniform dull brown without dusky centres to the feathers except on the narrow front.

*Remarks:* Compared with adequate series of *rufa* and *rufatra* from different parts of Brazil and Bolivia. It is possible that the record for this species from Sta. Ana, Urubamba Valley, Peru, should belong to the present race and not to *rufatra*, although the Urubamba is nearer to Reyes, on the Rio Beni, Bolivia, where *rufatra* was taken, than it is to the upper Huallaga. Only a direct comparison of the specimens in question will settle that for certain.

***Grallaria squamigera canicauda* Chapman.**

Having secured toptotypical material of this form in Bolivia last year, I am able to compare them with the three skins taken in different parts of Peru, and while the series is small, the following facts seem to be strongly apparent. A ♂ from Chira (=Tambillo of Stolzmann), Dept. Cajamarca is clearly referable to *squamigera*, having the lower back, scapulars and rump decidedly washed with olivaceous and the tail decidedly brownish. A ♂ taken at Llui (above Leymebamba) and another from Bagazan, just over the divide on the road from Molinopampa to Rioja, are exactly alike and are almost typical *canicauda*, although the tail has still a slight brownish cast and both are a little darker slate gray above than the Bolivian toptypes. The three Peruvian birds are a trifle deeper fulvous below and have the black markings a little smaller, while the Bolivian birds have the whole median part of the throat and a patch at base of throat pure white, which area in Peruvian skins is more or less tinged with fulvous, the Bagazan bird having the whole throat fulvous. Also the Bolivian birds have the subocular region, between the eye and the black malar streak, white instead of fulvous.

A young female from Bolivia has the entire upper parts and sides of head and neck and breast slaty black, with the feathers all broadly tipped with cinnamon ochraceous, and the abdomen, flanks, and crissum plain cinnamon ochraceous. This is the downy juvenal plumage.

***Synallaxis cherriei saturata* Carriker.**

Proc. Acad. Nat. Sciences, Vol. LXXXVI, p. 321, 1934 (Moyobamba, Peru).

When I described this bird I had not seen the article by Nils Gyldenstolpe (Arkiv för Zool., Stockholm), in which he had done exactly the same

thing as I,—recognize Cherrie's species and rename it *S. cherriei*. He then described in the same paper a new race of *cherriei* from the Rio Napo, Ecuador, calling it *napoensis*, which I find is apparently the same as my Moyobamba birds (as near as I can tell from his excellent description), and which I called *S. c. saturata*.

Therefore, *Synallaxis cherriei saturata* Carriker, becomes a synonym of *S. c. napoensis* Gyldenstolpe.

***Cranioleuca gutturata peruviana* (Cory).**

*Synallaxis peruviana* Cory, Auk, 36, p. 274, 1919 (Moyobamba, Peru).

A male and female of *C. g. gutturata*, taken at Chiñiri, Rio Beni, Bolivia, have been carefully compared with the pair taken at La Pampa, south Peru, and with the two ♂♂ of *peruviana* from Rioja, Peru.

The La Pampa birds are almost the same as the Chiñiri specimens, being just a little paler on the chest (less buffy-ochraceous wash). The two ♂♂ from Rioja and Moyobamba, when compared directly with the Bolivian birds bear out conclusively the validity of *peruviana*, which is much paler on the under parts and darker brown above. I have already called attention to the validity of *peruviana* in a previous paper. (Proc. Acad. Nat. Sciences, LXXXVI, p. 322, 1934.)

***Xiphorhynchus triangularis intermedius*, subsp. nov.**

Type from Eneñas, Dept. Junin, Peru, altitude 4,500 feet. No. 92511, A.N.S.P., ♀ adult, collected March 7, 1930, by M. A. Carriker, Jr., original No. 1284.

*Diagnosis*: About intermediate between *X. t. triangularis* and *X. t. bangsi* in some respects, but different from either. Markings of the pileum and back very close to those of *triangularis*, the mantle having but few faint shaft lines, but the general tone is much more brownish olive than either *triangularis* or *bangsi*; the whole rump is chestnut rufous, but slightly paler than in *bangsi*; wings bright rufous chestnut, and edgings paler brown, as in *bangsi*; throat decidedly white, with the feather edgings darker olive; under parts decidedly pale brownish olive, much lighter and browner than in *bangsi*, with the spots smaller than in *bangsi* and absent from belly, but reappearing on crissum in the form of a few narrow shaft lines.

*Remarks*: Another female taken at Eneñas on the same day as the type. Compared with five skins of *X. t. bangsi* from Sandillani, Bolivia, and with five skins from southeast Peru, and with ten skins of *triangularis* from North Peru, two from east Ecuador, and two from near Bogota, Colombia. The south Peruvian skins of *bangsi* are not quite typical, being slightly more brownish below than in Bolivian specimens, but are nearer to *bangsi* than to *intermedius*.

**Xiphorhynchus obsoletus parvimaculatus** Carriker.

Proc. Acad. Nat. Sciences, LXXXVI, p. 323, 1934 (Huacamayo, Peru).

Three skins of this form were taken recently at Chifñiri, Bolivia, which agree exactly with the three from Huacamayo. I have compared these six skins with a large series of *Xiphorhynchus spixii juruanus* (Ihering) from the Rio Purus (identified by Hellmayr), and they prove to be exactly the same. Therefore *X. obsoletus parvimaculatus* Carriker becomes a synonym of *X. spixii juruanus* (Ihering).

**Campylorhynchus trochilirostris zarumillanus** Sztolcman.

Ann. Zool. Mus. Hist. Nat. Polon., 1926, p. 222 (Lechugal, northwest Peru).

I have before me two ♂♂ of this species collected at La Laja, north Piura, Peru, near the Ecuador frontier, on June 12, 1933. I have compared them with three ♂♂ and one ♀ of *C. t. thoracicus* from west Ecuador (Naranjo and Bucay, Prov. Guayas). There is no question of the validity of *zarumillanus*. It is a much larger bird in every way, with the bill much longer and much less decurved. The upper parts are darker brown, with the fulvous streaks on the mantle broader and covering the whole mantle and scapulars; the rump is darker chestnut; the under parts are brighter, richer brown, without any buffy tinge, but with the fulvous streaking about as in *thoracicus* (the shade of fulvous on the streaks as well as the ground color varies slightly in intensity in different individuals).

*Measurements:* *C. t. zarumillanus*, 2 ♂♂; wing, 106, 105 mm.; tail, 102, 106 mm.; bill (across the arc), 78, 75 mm.; *C. t. thoracicus*, 3 ♂♂; wing, 97, 99, 97 mm.; tail, 95, 95, 97 mm.; bill, 61, 65, 67. (The tails in all the specimens are fresh and practically unworn.)

**Muscisaxicola tenuirostris** Carriker.

Proc. Acad. Nat. Sciences, LXXXIII, 1931, p. 458 (Rock Forest, near Lake Junin, Peru).

Two females of a *Muscisaxicola* were taken last year by the Academy expedition at La Cumbre, Bolivia, alt. 15,000 feet (near La Paz).

A comparison of these two skins with the type of *M. tenuirostris* (a ♀) proves them to be identical. When this species was described I assumed that its nearest relative was *M. cinerea*, but further study shows that it is probably nearer to *albilora*, which has been recorded several times from Peru as a migrant from the south. I have compared again these three specimens with authentic skins of *albilora*, in fresh plumage, and while there is some superficial resemblance, I am still of the opinion that it is not conspecific with it, and that it had better remain as a distinct species.

**Pyrocephalus rubinus major** Pelzeln.

*Pyrocephalus major* Pelzeln, Orn. Bras., 2, p. 115, footnote, 1868 (locality unknown).

Dr. Hellmayr has recorded this race of the Vermillion Flycatcher from the Dept. of Puno, southeast Peru. In the collection which I made last



year for this Academy on the upper Rio Beni, Bolivia, is a series of 4 ♂ ♂ and 2 ♀ ♀ of *P. rubinus* which agree in every way with a series of *P. r. rubinus* from Matto Grosso, Brazil (Descalvados). In the Academy collection are three skins (2 ♂ ♂, 1 ♀) of *P. rubinus* from Huacamayo, Dept. Puno, Peru, which I had identified somewhat doubtfully as *P. r. major*, following Dr. Hellmayr. I now find that these three skins agree in every respect with the series from the upper Beni and Matto Grosso.

Birds from northeast Peru from the Huallaga down to the Ucayali are given under *P. r. rubinus*, so that there remains only the region of the Department of Cuzo for the range of *P. r. major*, providing it can be maintained, which is somewhat doubtful, at least in Peru.

***Elaenia obscura obscura*** (Lafresnaye and D'Orbigny).

*Muscipeta obscura* Lafres. & D'Orb., Syn. Av. I, in Mag. Zool., 7, cl. 2, p. 48, 1837 (Yungas, Bolivia).

A series of 3 ♂ ♂ and 6 ♀ ♀ from Sandillani, Yungas of La Paz, Bolivia, which may be taken as topotypes of this species, have been carefully compared with our series of *E. obscura* from Peru, from the following localities: Eneñas, 1 ♂; Huacapistana, 1 ♂ (Dept. Junin); Tamborapa, 3 ♂ ♂ and Chira, 1 ♀ (Dept. Cajamarca). The Chira bird is a topotype of *E. obscura stolzmanni* Ridgway. It is a curious fact that the Chira bird exactly matches the Bolivian series of *obscura*, being duller and grayer below and with the upper parts darker and browner, while the remaining five Peruvian skins are uniformly distinct, being much yellower below and more olive above. The characters given by Hellmayr for *stolzmanni* fit exactly these five Peruvian skins, as compared with the Bolivian topotypes of *obscura*. I believe that *stolzmanni* is a perfectly good race, and that all birds from Peru, at least from Chanchamayo north, belong to it and not to *obscura*. I have seen no material from south Peru.

I cannot explain the resemblance of the Chira bird to the Bolivian series, but further material from that region may show it to be merely an individual variant.

***Cistothorus platensis minimus***, subsp. nov.

Type from Oconeqe, Dept. Puno, Peru, altitude 9,000 feet. No. 102580, A.N.S.P., ♂ adult, collected May 27, 1931 by M. A. Carriker, Jr., original No. 3172.

*Diagnosis:* Nearest to *C. p. graminicola* of central Peru, having the streaked pileum, but very much smaller and differing in other respects.

Streaking of pileum paler, nearer buffy ochraceous, and that of mantle pale cream in ♂ and whitish in ♀ (instead of ochraceous); rump plain brown, but upper tail coverts faintly barred with black (rump streaked with dusky in *graminicola*); tail darker rufous, with the black cross bars much narrower

(more like *aequatorialis*); under parts as in *graminicola*, except almost no ochraceous on chest and the brown of flanks darker; the wings are darker, the markings on outer web sandy brown, not buffy ochraceous, and barring narrower; upper tail coverts darker brown.

*Measurements:*

*C. p. graminicola*, 2 ♂♂; wing, 49, 52.5 mm.; tail, 43, 53 mm.; bill, 12.5 mm. 2 ♀♀; wing, 49, 53 mm.; tail, 52, 54 mm.; bill, 11.5, 12 mm.

*C. p. minimus*: (type); wing, 43 mm.; tail, 43 mm.; bill, 12 mm. (♀ paratype) wing, 42 mm.; tail, 43 mm.; bill, 12 mm.

*Remarks:* In Dr. Hellmayr's revision of this group (Birds of the Americas, p. 121, under *C. p. graminicola* for references) he does not give *aequatorialis* as occurring in Peru, but in reality all the birds from northern Peru belong to that form. I have ten skins from Uctubamba, Cochabamba, and Patas (Dept. Libertad), Atuen (Amazonas) and Chira, (Cajamarca), which are all typical *aequatorialis* and cannot be distinguished from a series from Ecuador. Of *graminicola* I have but two females, from Auquimarca and Upamayo, Junin, but they are in good, fresh plumage. A series of six skins from Cillutincara, Dept. La Paz, Bolivia average a little larger than the pair of *minimus*, but seem to be close to them in other respects, although they are all in the post nuptial molt and not comparable. Until fresh material from Bolivia has been secured, it is not possible to allocate with certainty their systematic position, but it would seem logical that they would belong to the race described above.

***Catharus dryas ecuadoreanus*, subsp. nov.**

Type from Alamor, Ecuador. No. 83646, A.N.S.P., ♂ adult, collected by Cherrie and Gill, September 15, 1921.

*Diagnosis:* Differs from *C. d. dryas* of Guatemala in having the upper parts Dark Mouse Gray (instead of Dark Olive Gray); the under parts are paler, pale cream (instead of Naples Yellow), with the spotting of the chest paler ashy, the spots larger and not so distinct, while the extent of dark ashy gray on the sides of chest and body generally is paler and encroaches more over the breast. (In *dryas* the sides of the body have the gray distinctly washed with olivaceous. The Ecuador bird is also considerably smaller, as shown by the measurements below.

*C. d. ecuadoreanus* differs from *C. d. maculatus* of Peru and Bolivia in having the upper parts very much paler and grayer and in the much sparser spotting of the under parts, *maculatus* having the whole of the under parts spotted with black from (and including) the throat down to the upper abdomen. The new race also has less whitish area on the throat, the black of the sides of the head encroaching more over the sides of the throat.

*Measurements:*

*C. d. dryas*; (2 unsexed skins from Yzabal, Guatemala) wing, 98, 100 mm.; tail, 81 mm.; tarsus, 37, 38.5 mm.

*C. d. ecuadoreanus*: (1 ♂ and 1 ♀) wing, 93, 87 mm.; tail, 75, 70 mm.; tarsus, 32.5, 33 mm.

***Turdus ignobilis sandiae*, Carriker.**

*Turdus ignobilis sandiae* Carriker, Proc. A.N.S.P., LXXXV, p. 34, 1933 (Huacamayo, Dept. Puno, Peru).

I have recently compared the type of *T. i. sandiae* with a good series of *T. amaurochalinus* Cabanis from northern Bolivia, and find them to be identical. Therefore *T. i. sandiae* Carriker, becomes a synonym of *T. amaurochalinus* Cabanis.

***Hylophilus ochraceiceps viridissimus*, subsp. nov.**

Type from Moyobamba, Dept. San Martin, Peru, altitude 3,500 feet. No. 116659, A.N.S.P., ♂ adult, collected October 17, 1933 by M. A. Carriker, Jr., original No. 8099.

*Diagnosis*: Closest to *H. o. viridior* of Sta. Cruz, Bolivia, but differing from that race in the very much darker olive green of the upper parts, less olive across the chest, and the tail less brownish' (greener).

It differs more noticeably from *H. o. ferrugineifrons*, the race nearer to it geographically, than it does from the southern bolivian race.

Compared with the type and eleven skins of *viridior* from Sta. Cruz, Bolivia, with 4 ♂♂ and 4 ♀♀ from the upper Rio Beni, Bolivia, and with four skins from Huacamayo, south Peru, as well as with several skins of *H. o. ferrugineifrons*. The birds from south Peru and north Bolivia are intermediate between *viridior* and *viridissimus*, being closer to the former. They are a little brighter olive green on the back and with the rufous of the front and crown extending further back, almost to the occiput, while in *viridior* this color practically ends just behind the eye. In *viridissimus* the rufous crown also extends nearly back to the occiput. In *ferrugineifrons* the back is decidedly brownish olive, the front darker rufous, darker chest and sides, and decidedly yellowish abdomen (not grayish).

***Diglossa caerulescens intermedia*, subsp. nov.**

Type from Chira, Dept. Cajamarca, Peru, altitude 7,500 feet. No. 116486, A.N.S.P., ♂ adult, collected August 23, 1933, by M. A. Carriker, Jr., original No. 7529.

*Diagnosis*: Almost exactly intermediate between *D. c. saturata* of Colombia and *D. c. pallida* of central and south Peru. The upper parts are brighter, clearer blue than in *pallida* or *saturata*, while the throat and chest are deep blue, almost the same shade as in *saturata* and *caerulescens*, except that it lacks the slight purplish-violet shade present in those two races. At the posterior edge of the chest there is a sharp transition of color, the breast and abdomen being bluish white, paler even than in *pallida*, which has the whole of the under parts almost uniform pale grayish blue; the under tail coverts are so broadly edged with whitish as to almost conceal the blue-gray bases of the feathers.

*Remarks:* In addition to the type two more males were taken at the same locality. All are in fresh, fully adult plumage. Compared with seven skins of *pallida* from Huacapistana (topotypes), Auquimarca, and Sto. Domingo, which are all very uniform in color. Also with eight skins of *saturata* from Colombia (four topotypes); two skins of *caerulescens* from Merida and Caracas, Venezuela. Six skins from Leymebamba, Peru are also referable to this new form, but are not quite typical, being slightly intermediate with *pallida*, agreeing with the type of *intermedia* in the color of the back and abdomen and abrupt transition between chest and breast, but the throat and chest are paler, grayish blue, about as in *pallida*.

**Tangara argyrophenges caeruleigularis**, subsp. nov.

Type from Rio Jelashte, Dept. San Martin, Peru, altitude 5,000 feet. No. 109178, A.N.S.P., ♂ adult, collected August 20, 1932, by M. A. Carriker, Jr., original No. 5946.

*Diagnosis:* Similar to *T. a. argyrophenges* of Bolivia, in general color pattern, but differing as follows: Back, scapulars, rump and upper tail coverts slightly paler, silvery Cream Color, instead of shining Naples Yellow, this color extending down over the tips of the longest upper tail coverts, the bases of which are black. (In *argyrophenges* all of the longer upper tail coverts are black to the tips). The color of the throat is quite different in the new form, which, together with the sides of the head, ear coverts and sides of neck are shining silvery blue, with a slight greenish shade in certain lights (near to Light Glaucous Blue), while in *argyrophenges* these areas are decidedly silvery greenish, near Dark Greenish Glaucous. The sides and flanks are also paler, the same color as the back; the inner edges of the remiges, on the under side, are paler, being narrowly edged with white; the bill is considerably heavier, more swollen at the base, but of the same length.

*Remarks:* In addition to the type, 1 ♀ and 2 ♂ very slightly immature were taken at the same place. They were compared with 2 adult males and 1 slightly immature male from Samaipata, Dept. Sta. Cruz, Bolivia. (Coll. Carnegie Museum).

The type of *argyrophenges* was collected by Buckley in 'Bolivia', which means that it came from some place in the Yungas of La Paz, so that we cannot be absolutely certain that the Samaipata birds are typical, but taking other species from the same area as a criterion, I think that we may assume that they are the same. The type seems to be the only specimen of the species known from Bolivia (except the 3 ♂ in the Carnegie Museum from Samaipata). Taczanowski records specimens taken by Stolzmann at Huambo, Dept. San Martin, Peru, which locality is not far from the type locality of *caeruleigularis*, and without doubt Taczanowski's description of the species (Ornithologie du Pérou) was made from Huambo specimens (*caeruleigularis*), although, at the beginning, he quotes Sclater's

latin diagnosis of *argyrophenges*. In Selater's account of the species (Cat. Birds Brit. Mus., Vol. XI, p. 137) he has used the type for his description of the male, and one of Stolzmann's Huambo birds for that of the female, so that in reality the female of *argyrophenges* is still unknown, as far as I am aware.

Description of *T. a. caeruleigularis* female:

Pileum and nape blackish, the feathers rather broadly edged with blue-green, brighter on the front and duller on the nape; rest of upper parts golden olive; wings and tail black, broadly edged with Forest Green; throat, sides of head, sides of neck and upper chest dull Silvery Glaucous, with a slight wash of tawny on the sides of the throat; breast and abdomen about Storm Gray, the feathers narrowly edged with white (more apparent on the abdomen); sides of chest and body golden olive; flanks and crissum near Forest Green, the latter slightly edged with whitish; under wing coverts white (except greater primary coverts blackish), and lining of wing white.

***Delothraupis castaneiventris peruvianus*, subsp. nov.**

Type from Auquimarca, Dept. Junin, Peru, altitude 8,000 feet. No. 102213, A.N.S.P., ♂ adult, collected February 13, 1931 by M. A. Carriker, Jr., original No. 1979.

*Diagnosis:* Differs from *castaneiventris* of Bolivia and south Peru in the darker, richer, more uniform rufous color of the under parts, especially of the throat, and the greater length of wing.

In *castaneiventris* the abdomen is deep chestnut rufous, which color becomes gradually paler up over the breast and chest, until it becomes almost white on the upper throat and ochraceous on lower throat, while in *peruvianus* the whole of the under parts are the same uniform color as the abdomen. In *castaneiventris* the base of the malar stripe (in front of eye) is white, which color gradually changes through cream and pale cinnamon into the paler rufous of the chest. The black mustachial streak in *peruvianus* is much narrower and shorter; the bill is noticeably larger and the wing considerably longer.

*Measurements:*

*D. c. castaneiventris*; (2 ♂♂ and 1 ♀ from Hichuloma, Bolivia) wing, 79, 78.5, 76 mm.; (3 ♂♂ and 1 ♀ from Oconeque and Sto. Domingo, s. Peru), 80, 80, 80.5, 79 mm.

*D. c. peruvianus* (type and 4 ♀♀ from Auquimarca, Peru) wing, 87, 85, 82, 82, 80 mm.

*Remarks:* One ♀ from Oconeque and 1 ♀ from Hichuloma are deeper rufous below than the rest of the series of *castaneiventris*, but are noticeably paler than the Auquimarca skins of *peruvianus*, and the throat is as pale as the rest of the southern series. There is some variation in the amount of silvery-blue tips to the feathers of the upper parts, but without regard to locality or sex, being apparently merely an individual character without regard to locality, sex, or age.

***Diuca speculifera magnirostris*, subsp. nov.**

Type from Yanac, Dept. Ancash, Peru, altitude 15,000 feet. No. 109086, A.N.S.P., ♂ adult, collected March 26, 1932 by M. A. Carriker, Jr., original No. 4583.

*Diagnosis:* Like *D. s. speculifera* of Bolivia and south Peru in color, but bill decidedly longer and higher at base, but not wider, averaging 2 mm. longer and about 1 mm. higher at base, giving it a much more slender, tapering outline.

*Remarks:* Birds from central Peru (La Galera, Dept. Junin) have the bill almost as long as the Yanac birds, and, with the exception of two skins out of seven, very uniform in length (16 to 16.5 mm.). One ♂ and 1 ♀, however have the bill almost as short as the Bolivian series which measures 14 to 15 mm. (average, 14.25 mm.). Five skins from Aricoma Pass and Huancarani, Dept. Puno, average 14.5 mm.

**SOUTH AFRICAN FISHES RECEIVED FROM MR. H. W. BELL-MARLEY  
IN 1935**

BY HENRY W. FOWLER.

The materials reported in this paper are chiefly of interest as they include some of the rarest and little-known species of the Natal region. Several are outstanding rediscoveries of Indian Ocean species, very imperfectly known, and at least one has rested in oblivion over a century. Others are additions to the South African fauna. The collection includes 291 specimens representing 167 species of which nine are described as new, besides three new genera.

Credit is due Mr. Bell-Marley for his efforts in securing such valuable materials, the more important of which are accompanied by color notes from the fresh or living specimens. These are indicated by the use of quotation marks. If no other locality is given it is assumed the species was obtained at Durban. The Academy is again indebted to Mr. Bell-Marley for this gift to its collections.

**SCYLIORHINIDAE**

***Scyliorhinus natalensis*** Regan.

One, 560 mm.

***Scyliorhinus leopardus*** Fowler.

One, 649 mm., ♂. Agrees with the small type.

***Halaelurus punctatus*** (Gilchrist). Figure 1.

Depth 8 to subcaudal origin; head  $5\frac{1}{3}$ , width  $1\frac{1}{8}$ . Snout 2 in head; eye  $4\frac{1}{3}$ , 2 in snout,  $2\frac{1}{2}$  in interorbital; mouth width 2 in head; no labial folds; teeth about 34 rows above, 38 rows below, with rather narrowly triangular median cusp and apex little curved; edges entire; preoral length  $2\frac{3}{4}$  in mouth width; nostrils large, opposite front edge of upper lip, flaps without cirri, internarial equals preoral length; interorbital  $2\frac{1}{4}$  in head, flattened, depressed medianly. Gill openings small, all well above pectoral base, first largest or 4 times last.

Scales minute, tridentate, cusps subequally large.

First dorsal origin over middle of ventral length, front fin edge 2 in head; second dorsal inserted over hind basal portion of anal, front fin edge 2; front anal fin edge 3, fin length  $1\frac{1}{3}$ ; caudal 3 in rest of fish, front subcaudal edge  $2\frac{3}{4}$  in caudal length; pectoral  $1\frac{1}{4}$  in head, width  $1\frac{1}{4}$  in its length; ventral length equals head, fins united behind; clasper long as ventral base.

General color light brown. Back and upper surfaces with close-set, small, dark-brown spots; about 12 across interorbital; on sides, delimiting spotted upper area from pale lower uniform area, row of rather large,

irregular, well-spaced brownish blotches, these extended forwards along side of head. All upper surfaces of paired fins, dorsal and caudal, with rather large brownish spots, irregular and variably distinct. Iris grayish.

One, 310 mm. I have not seen Gilchrist's original account and identify the species from Barnard, though his description of its coloration is quite different. My specimen agrees in most every respect with *Scyliorhinus (Halaehurus) polystigma* Regan 1921.

**Cephaloscyllium suffians** (Regan). Figures 2 (lateral view partly inflated), and 3 (mouth below).

Depth (contracted)  $5\frac{1}{2}$  to subcaudal origin; head  $4\frac{2}{3}$ , width 1. Snout 3 in head; eye 4,  $1\frac{3}{4}$  in snout, 2 in interorbital; mouth width  $1\frac{3}{4}$  in head; no labial folds; lower lip with slight notch close before rictus; teeth about 60 rows above, about 44 rows below, with rather large cusps, as little longer median one, and one on each side, edges entire; inside mouth strongly papillate; preoral length 3 in mouth width; nostrils rather large, extend behind front edge of upper lip, flaps without cirri, internasal  $1\frac{1}{2}$  in preoral length; interorbital  $1\frac{3}{4}$  in head, low, broadly depressed. Gill openings moderate, all well above pectoral base, third largest and last smallest.

Scales moderate, rather rough to touch, simple, triangular, pointed denticles.

First dorsal origin over first fifth of ventral base, front fin edge  $1\frac{3}{4}$  in head; second dorsal origin over first fifth of anal base, front fin edge  $2\frac{1}{2}$  in head; front anal fin edge 2, fin length  $1\frac{1}{4}$ ; caudal 2 in rest of fish, front subcaudal edge  $1\frac{3}{4}$  in head; pectoral  $1\frac{1}{2}$ , width  $1\frac{1}{2}$  in its length; ventral length  $1\frac{3}{4}$  in head, fins only very slightly united basally behind; short, rounded, rudimentary clasper  $\frac{1}{2}$  of eye.

Back and head above olive gray to heliotrope purple, becoming uniform pale buff on under surfaces. Under surfaces of all fins grayish. Iris gray.

One, 375 mm. In the contracted stage the belly is loose and flabby. "This fish, when brought to the surface, was found with the belly inflated with water. Colour plum blue, with darker cross bars, fading paler on sides. From trawl net, in 70 to 80 fathoms, Natal coast."

## ORECTOLOBIDAE

**Stegostoma tygrinum** (Bonnaterre).

One, 877 mm., May 3, 1932. "Rich buff, shading paler on belly, markings black." It agrees with a little smaller Bombay specimen in the collection, received in 1925. New for Natal.

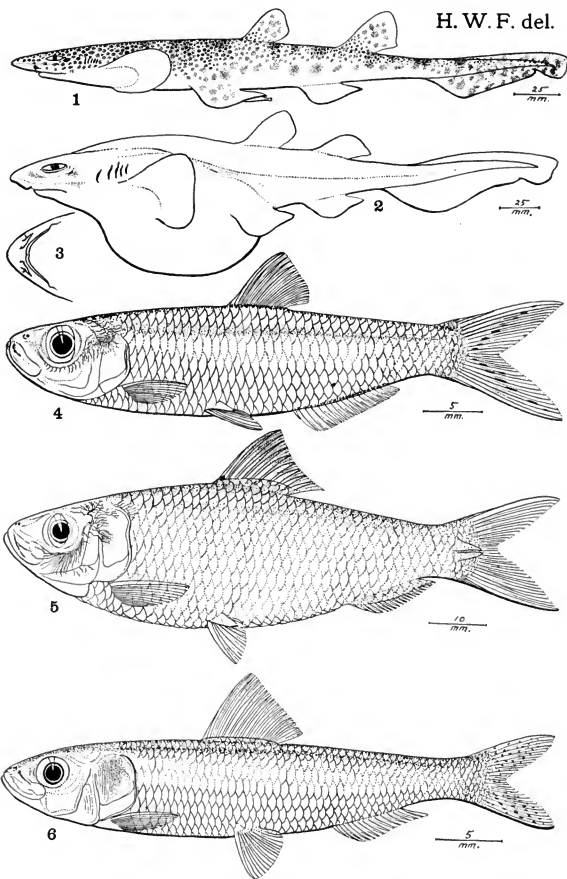
## EULAMIIDAE

**Eulamia limbatus** (Müller and Henle).

Depth  $6\frac{1}{2}$  to subcaudal origin; head  $4\frac{2}{3}$ , width  $1\frac{3}{4}$ . Snout  $2\frac{1}{4}$  in head; eye  $7\frac{1}{2}$ , 3 in snout,  $4\frac{1}{4}$  in interorbital; mouth width  $2\frac{3}{4}$  in head, length  $1\frac{3}{4}$  in its width; very short upper and lower labial fold at each rictus; upper teeth little broader, triangular, with minutely serrated edges, lower narrow and entire; nostrils about midway in preoral length, about  $\frac{3}{4}$  of eye, short flap



H. W. F. del.

1. *Halaelurus punctatus*.4. *Gilchristella aestuarius*.2, 3. *Cephaloscyllium sufflans*.5. *Sardinella jussieu*.6. *Sardina sagax*.

broad and entire; preoral length  $2\frac{2}{3}$  in head; interorbital  $1\frac{1}{3}$ , broad, convex. Gill openings moderate, all above pectoral base, third largest or little larger than eye, last smallest.

Scales minute, very fine and rough to touch, tridentate and tricarinate.

First dorsal begins opposite hind angle of pectoral, front fin edge  $1\frac{1}{2}$  in head, posterior lobe of fin  $3\frac{1}{2}$ ; second dorsal begins slightly before anal, front fin edge  $2\frac{2}{3}$ ; front anal fin edge 3; caudal  $2\frac{3}{4}$  in rest of fish; front subcaudal edge  $1\frac{1}{2}$  in head or  $2\frac{2}{3}$  in caudal length; pectoral equals head, width  $1\frac{1}{3}$  in its length; ventral  $1\frac{1}{2}$  in head; fins separated.

Back and upper surfaces uniform gray. Below whitish. Iris gray. Second dorsal with large black apical blotch.

One, 630 mm. long.

### SQUALIDAE

#### *Atractophorus armatus* Gilchrist.

Depth 7 to subcaudal; head  $4\frac{1}{3}$ , width  $1\frac{1}{2}$ . Snout  $2\frac{1}{2}$  in head; eye  $4\frac{1}{3}$ ,  $1\frac{1}{3}$  in snout,  $2\frac{2}{3}$  in interorbital; mouth width  $2\frac{1}{4}$  in head, very long, upper labial groove  $1\frac{1}{2}$  in mouth width and extends half its length behind rictus; lower labial groove  $\frac{1}{2}$  mouth width; about 34 rows of teeth above, and 24 rows below, crowns all directed laterally; nostrils moderate, midway in snout length,  $\frac{1}{2}$  of eye, each with short, simple, triangular flaps; internarial 3 in preoral length, which  $1\frac{1}{3}$  in head; interorbital  $2\frac{1}{2}$ , low, depressed, surface but slightly convex. Gill openings small, all before pectoral, last largest or  $1\frac{1}{2}$  in eye.

Scales minute, simple, pointed tubercles, rough to touch.

First dorsal begins well behind pectoral base or about over middle of inner pectoral lobe, fin length  $1\frac{1}{2}$  in head; second dorsal begins well behind ventral, fin length  $1\frac{1}{3}$  in head; caudal  $3\frac{1}{4}$  in rest of fish, front subcaudal edge  $2\frac{2}{3}$  in caudal; front pectoral edge  $1\frac{1}{2}$  in fin length, which equals head; ventral length  $1\frac{1}{3}$ , fins separated, pointed claspers moderate.

Back and upper surfaces gray brown, under surfaces lighter brown. Iris blackish.

One, 660 mm. This specimen greatly larger than 355 mm. as given by Barnard. It also differs from his outline figure in the fins placed more distant from one another, doubtless due to age.

### TORPEDINIDAE

#### *Torpedo panthera* (Olfers).

Two, 135 to 138 mm.

### DASYATIIDAE

#### *Dasyatis uarnak* (Forskål).

One, 373 mm., disk width 228 mm. A single tubercle in middle of disk above. Tail with rather obscure, regular, dark blotches along sides whole extent. Lower surface of disk cream white, with broad brown margins to pectorals.

## DUSSUMIERIIDAE

## GILCHRISTELLA, new genus

Body elongate, rather slender, well compressed. Head rather small. Snout conic. Eye large, high, median in head, without adipose lids. Mouth terminally superior, lower jaw slightly projecting. Maxillary reaches eye. No teeth. Gill rakers slender, fine, long. Branchiostegals 7. Scales rather large, narrowly imbricated, very deciduous. Belly, both before and behind ventrals, rounded, without scutes or denticles, scales passing over. Dorsal inserted nearer snout than caudal base, fin moderate. Anal begins below last dorsal rays, base rather long or extends  $\frac{2}{3}$  in space to caudal base. Caudal forked. Pectoral low, short. Ventral inserted well before dorsal, reaches vent, which close before anal.

Type *Spratelloides aestuarius* Gilchrist.

Small, weak fishes, with very deciduous scales and narrow, ill-defined silvery lateral streak. The genus differs from *Etrumeus*, *Dussumieria*, *Spratelloides*, and *Montalbana*, chiefly in its advanced ventrals.

(For the late Dr. J. D. F. Gilchrist, author of many important papers on the fishes of South Africa.)

*Gilchristella aestuarius* (Gilchrist). Figure 4.

Eight, 44 to 51 mm. Blue lagoon, in enclosed water. August 2, 1933.

The type of *Spratelloides* Bleeker 1852 is *Clupea argyrotaenia* Bleeker 1849, monotypic = *Clupea gracilis* Schlegel 1847. In this species the ventral is inserted below the hind dorsal rays, therefore Barnard's statement under *Spratelloides* "Ventrals almost or entirely in front of dorsal" is not in accord.

*Spratelloides madagascariensis* Sauvage 1883 is evidently not a *Spratelloides* as his figure in 1891 shows the ventral profile with abdominal scutes, though these are not mentioned in the description.

## CLUPEIDAE

*Sardinella jussieu* (Lacépède). Figure 5.

One, 111 mm., Durban beach, 1931.

*Hilsa durbanensis* (Regan).

One, 94 mm., Durban beach, 1931. Colored like 1932 specimen I reported.

*Sardina sagax* (Jenyns). Figure 6.

Forty-two, 32 to 48 mm., washed ashore on ocean beach, Durban, Nov. 10, 1933.

*Ilisha natalensis* (Gilchrist and Thompson). Figure 7.

Depth 3; head  $3\frac{1}{2}$ , width  $2\frac{1}{2}$ . Snout 3 in head measured from snout tip; eye 3, equals snout, little greater than interorbital; maxillary reaches opposite front eye edge, expansion  $1\frac{1}{2}$  in eye, length  $2\frac{1}{2}$  in head from snout

tip; teeth minute, in narrow band or series on jaw edges and maxillary edges; interorbital  $4\frac{1}{2}$ , low, depressed medially; opercles and cheeks striate. Gill rakers  $14 + 25$ , lanceolate,  $1\frac{3}{4}$  of eye; gill filaments  $\frac{2}{3}$  of gill rakers.

Scales 44 in median lateral series to caudal base; 10 transversely between dorsal and ventral; 14 predorsal. Scales with 4 to 6 transverse striae; all incomplete except most basal one. Abdominal scutes  $19 + 8$ .

D. III, 13, 1, first branched ray  $1\frac{1}{2}$  in total head length; A. III, 35, 1, first branched ray  $2\frac{1}{4}$ ; caudal  $1\frac{1}{2}$ ?, deeply forked; least depth of caudal peduncle 3; pectoral  $1\frac{3}{8}$ ; ventral 4.

Back olive, also upper surface of head. Broad adipose eyelids whitish. Sides of head, sides and under surfaces of body silvery white. Dorsal and caudal olive gray, other fins whitish. Underlaid grayish, ill defined axial band on sides of body.

One, 193 mm.

#### ENGRAULIDAE

*Anchoviella holodon* (Boulenger).

Three, 92 to 96 mm., Durban beach, 1931.

*Thrissocles vitirostris* (Gilchrist and Thompson).

One, 80 mm., with the preceding species. One, 180 mm., from Durban.

#### GONOSTOMIDAE

*Vinciguerria sanzoi* Jespersen and Taaning. Figure 8.

One, 44 mm., washed ashore with plankton at Durban beach, Nov. 7, 1932. Known from the Atlantic, this interesting species here recorded from Natal for the first time.

#### SYNODONTIDAE

*Saurida tumbil* (Bloch).

One, 250 mm. Outer anterior series of palatine teeth in 3 series transversely. Not previously reported from Natal.

*Trachinocephalus myops* (Schneider).

One, 103 mm., Durban beach, 1931.

#### MURAENIDAE

*Muraena mossambica* (Peters).

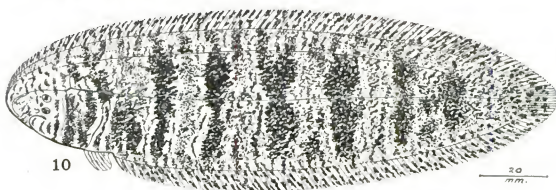
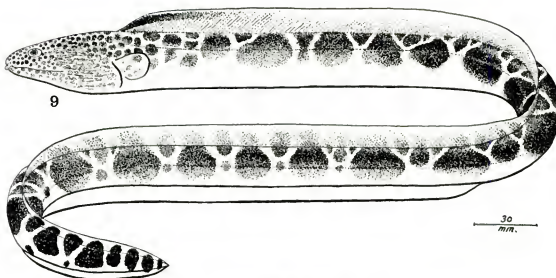
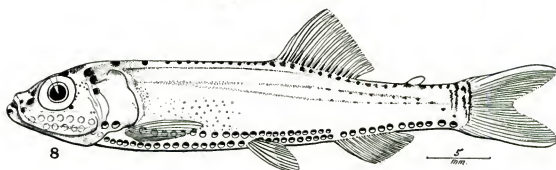
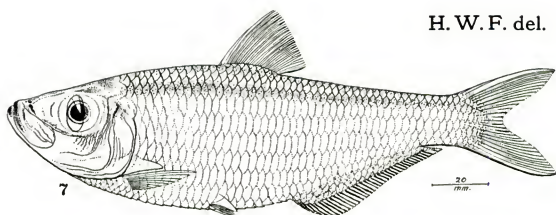
Four uniformly colored examples, 108 to 222 mm., from first dam at Paulpietersburg. Five, 225 to 410 mm., of which only one with the dorsal origin little nearer pectoral origin than vent, in all others nearer vent.

Two, 300 to 315 mm., from Durban, with back mottled with darker.

*Muraena australis* (Richardson).

Depth  $13\frac{1}{4}$ ; head  $6\frac{1}{2}$ , width  $2\frac{3}{8}$ . Snout  $5\frac{1}{2}$  in head from snout tip; eye 13,  $2\frac{1}{4}$  in snout,  $2\frac{2}{3}$  in interorbital; mouth cleft  $3\frac{2}{3}$  in head; teeth in broad bands in jaws, anteriorly 12 to 14 irregularly in transverse count; lips broad,

H. W. F. del.



7. *Ilisha natalensis*.  
9. *Ophichthus retifer*.

8. *Vinciguerria sanzoi*.  
10. *Cynoglossus durbanensis*.

well marked laterally; interorbital  $5\frac{3}{4}$  in head, low, convex. Gill opening  $8\frac{1}{4}$  in total head; interbranchial space 4.

Scales slender or narrow.

Dorsal begins snout length in advance of anal origin, also before vent; caudal  $4\frac{3}{4}$  in head; pectoral  $3\frac{1}{2}$ .

Back and upper surfaces uniform olive, under surfaces very pale brown. Iris gray.

One, 753 mm. Barnard mentions it as taken only once in South Africa.

### CONGRIDAE

#### *Leptocephalus* species?

One, 85 mm., Durban beach, April 19, 1933. This larval stage I have not located.

### OPHICHTHYIDAE

#### *Ophichthus unicolor* Regan.

Two, 490 to 573 mm. In smaller example belly nearly orange.

#### *Ophichthus apicalis* (Bennett).

One, 172 mm., Blue Lagoon, Durban coast, March 3, 1934. Although Barnard says "Cleft of mouth extending to, but not beyond, hind margin of eye," both of Bleeker's figures he refers to show the mouth cleft well extended back of the eye. In my specimens it extends behind the eye nearly an eye-diameter. My other example 296 mm.

#### *Ophichthus retifer*, new species. Figure 9.

Depth  $23\frac{1}{4}$ ; head 12, width 2. Snout  $4\frac{3}{8}$  in head; eye  $9\frac{1}{4}$ , 2 in snout,  $1\frac{1}{2}$  in interorbital; mouth cleft extends little beyond eye,  $2\frac{1}{4}$  in head; front nostrils each in conspicuous tube at side of front end of snout, hind ones not distinct; teeth conic, rather strong, short, uniserial along sides of jaws, and irregularly biserial anteriorly; single row of teeth, similar, on vomer; interorbital 6 in head, low, nearly level. Gill opening 6; interbranchial space  $4\frac{1}{4}$ .

Skin smooth. On head and thorax many longitudinal grooves, producing a variegated wrinkled appearance. Lateral line distinct, axial, complete.

Dorsal begins opposite pectoral origin, greatest fin height  $4\frac{3}{8}$  in head; tail long as trunk without head; greatest anal height 5 in head; pectoral length  $3\frac{3}{8}$ ; end of tail firm, cartilaginous like point.

Head above and on sides with very numerous, crowded, close-set drab-gray spots; on head proper mostly less than eye in size, and on nape and thorax larger, all separated by narrow ecru-drab or lighter lines; on mandible more or less defined, though on throat and gullet spots pale, indistinct and scattered, replaced by general pale or light buff of lower surfaces. On side of trunk and tail 20 or more drab-gray large blotches; alternating an equal series of similar though smaller drab-gray blotches, most of which are still further divided with a smaller drab-gray blotch in front and one behind, along base of dorsal fin. The whole pattern of the back is thus marked with light reticulated lines delimiting the various

blotches. Under surface of trunk and tail nearly uniform light buff or pinkish buff. Dorsal pale grayish, anteriorly with short blackish gray submarginal band, and most of fin with very obscure and ill-defined pale brownish blotches. Anal uniformly light buff. Pectoral buff, with 3 series of pale brown rather large spots.

A.N.S.P., No. 63915. Durban, Natal. Length 718 mm. "Pale yellow, spotted boldly with rich brown, yellow brighter on head."

Greatly like *Microdonophis fowleri* Jordan and Evermann 1903, and its synonym *Ophichthys garretti* Günther 1910. In 1928 I thought both synonymous with *Ophichthys polyophthalmus* Bleeker 1865. This last, however, shows each of the dark spots on the head and back with a small central white spot. Although Bleeker's figure does not show it, Weber and Beaufort 1916 describe "margin of dorsal black."

*Microdonophis erabo* Jordan and Snyder 1901 from Misaki, Japan, is more like the present species than any other. Its dark blotches are more widely separated by pale interspaces.

(*Rete* net + *fero* to bear; with reference to the pale lines of the color pattern.)

#### ECHIDNIDAE

*Lycodontis favagineus* Schneider.

One, 628 mm.

*Lycodontis meleagris* (Shaw).

One, 845 mm.

*Echidna nebulosa* (Ahl).

One, 362 mm.

*Uropterygius concolor* Rüppell.

One, 232 mm. Greatly like the nominal *Anarchias allardicei* Jordan and Seale from Samoa, with the dorsal distinct its whole extent though the anal is only shortly subterminal. Uniform gray brown.

#### PLOTOSIDAE

*Plotosus anguillaris* (Bloch).

One, 220 mm.

#### CHARACIDAE

*Alestes imberi* Peters.

One, 180 mm.

#### CYPRINIDAE

*Barbus bowkeri* Boulenger.

Depth  $4\frac{1}{2}$ ; head 4, width  $1\frac{1}{3}$ . Snout  $2\frac{9}{10}$  in head; eye  $5\frac{1}{2}$ , 2 in snout,  $2\frac{1}{8}$  in interorbital; maxillary reaches  $\frac{7}{8}$  to eye, length  $3\frac{1}{2}$  in head; front barbel

long as eye, hind barbel  $1\frac{1}{2}$  times eye; lower lip forms free fold completely across front of mandible; interorbital  $2\frac{3}{4}$  in head, low, slightly convex; suborbitals narrow, about  $\frac{1}{2}$  in cheek to preopercular ridge. Gill rakers  $4 + 11$  lanceolate,  $\frac{1}{4}$  of gill filaments, which equal eye. Right pharyngeal teeth 5, 3, 2, but little hooked, with broad, smooth grinding surfaces.

Scales  $34 + 3$  in lateral line; 6 above, 3 below to ventral, 4 below to anal, 15 predorsal. Caudal base scaly. Ventral axillary scale 3 in fin. Scales with 37 basal marginal radiating striae; 35 parallel subapical striae; circuli fine, obsolete apically. Tubes in lateral line simple, nearly reach middle of scale exposure.

D. III, 8, 1, third simple ray largely flexible and entire, first branched ray  $1\frac{1}{3}$  in head; A. III, 5, 1, first branched ray  $1\frac{1}{3}$ ; caudal 1, well forked; least depth of caudal peduncle  $2\frac{1}{2}$ ; pectoral  $1\frac{1}{3}$ , rays 1, 16; ventral rays 1, 8, fin  $1\frac{2}{3}$  in head.

Back dark gray brown, color well contrasted with pale or brownish white of under surfaces. Iris brownish also upper edges of barbels which otherwise pale. Dorsal and caudal olive gray. Anal membranes grayish, rays whitish. Inner upper surfaces of pectoral olive, fin otherwise pale to whitish. Ventrals largely whitish, middle part of membranes grayish.

One, 265 mm.

**Barbus swierstrae** Gilchrist and Thompson.

Depth  $3\frac{1}{4}$ ; head  $4\frac{1}{2}$ , width  $1\frac{1}{2}$ . Snout  $2\frac{1}{2}$  in head; eye  $5\frac{1}{3}$ , 2 in snout,  $2\frac{3}{8}$  in interorbital; maxillary reaches  $\frac{3}{4}$  to eye, length  $3\frac{3}{8}$  in head; front barbel  $1\frac{1}{3}$  in eye, hind barbel  $1\frac{1}{8}$ ; mandible well included in upper jaw; lower lips lateral, leave median space at mandibular symphysis entire, for extent wide as eye; interorbital  $2\frac{1}{8}$ , low, broadly convex; suborbitals narrow, about  $\frac{1}{3}$  width of cheek to preopercular ridge. Gill rakers  $5 + 15$ , lanceolate,  $\frac{1}{4}$  of gill filaments, which  $1\frac{1}{4}$  times eye. Right pharyngeal teeth 5, 3, 2, outer robust, large, none hooked, grinding surfaces moderate, smooth.

Scales  $29 + 2$  in lateral line; 2 below to ventral, 4 below to anal, 11 predorsal. Caudal base with rather large scales. Axillary ventral scale  $2\frac{3}{8}$  in ventral. Scales with about 35 basal marginal radiating striae, variously incomplete and other auxiliaries; 96 apical radiating striae; circuli fine, all basal. Lateral line complete, decurved, tubes small, little exposed and more or less bifid.

D. III, 9, 1, third simple ray flexible, entire, first branched ray equals head; A. III, 5, 1, first branched ray  $1\frac{1}{10}$  in head, depressed fin reaching eye diameter behind caudal base; caudal 3 in rest of fish, deeply forked, lobes pointed; least depth of caudal peduncle  $1\frac{1}{2}$  in head; pectoral  $1\frac{1}{10}$ , rays 1, 15; ventral rays 1, 8, fin  $1\frac{1}{4}$  in head.

Back brown, sides and below paler, creamy on under surface of head. Iris gray. Barbels brownish. Mandible buff. Dorsal and caudal brown, other fins lighter brown. Membranes of paired fins and anal grayish.

One, 395 mm.

**Barbus trevelyani** Günther.

Thirteen, 43 to 70 mm. Barbel single, very small, and differs a little from Gilchrist and Thompson's account in this respect though their largest example 82 mm.



**Barbus ivongoensis** Fowler.

One, 44 mm., Uvongo River, Natal, 1933. Agrees with the type. This species was unfortunately proposed with erroneous spelling of the type locality. Due to the nearly illegible labels of this and others in my 1934 paper "Ivongo" was wrongly given on pp. 424, 428, 429, 430. In this same way other errors, which Mr. Marley has corrected in a recent letter, have resulted, thus: p. 416 for Nikuzi, read Mkuzi River; p. 422 for Zunyati, read Zinyati River; p. 426 for Rodivlerkji read, Rooivlerkji; p. 426 for Mkugi, read Mkuzi River; p. 429 for Umzuukulu, read Umzimkulu District; p. 431 for Helpma Kaon, read Helpmakaar; p. 434 for Tegula, read Tugela River; p. 455 for Umllynaas, read Umlaas River; p. 456 for alluvial, read Aliwal Shoal; p. 475 for John C. Meikk, read John C. Meikle; p. 509 for Umgui, read Umgeni.

**Barbus vulneratus** Castelnau.

One, 44 mm., Paulpietersburg District. L. A. Day.

**Barbus anoplus** Weber.

One, 57 mm., Heavy Tree Dam, Jan. 5, 1934. L. A. Day. Color silvery.

**Barbus unitaeniatus** Günther.

One, 80 mm., Uvongo River, 1933. Another interesting specimen, without definite locality 93 mm. It has the muzzle, interorbital region around the eyes, and the cheek with small pearl organs. Its dark basal caudal spot not so conspicuous as in my Angola materials.

**BOTHIDAE****Bothus pantherinus** (Rüppell).

One, 130 mm. D. 85. A. 68.

**Bothus mancus** (Broussonet).

One, 373 mm.

**SOLEIDAE****Solea bleekeri** Boulenger.

One, 114 mm.

**Zebrías regani** (Gilchrist).

Depth  $2\frac{3}{4}$ ; head 5, width  $2\frac{3}{5}$ . Snout  $4\frac{1}{2}$  in head as measured to lower eye; lower eye  $4\frac{1}{5}$ , little greater than snout; right mouth cleft reaches  $\frac{1}{2}$  in lower eye, 3 in head; left mouth cleft 4; interorbital not distinct. Gill rakers as 3 short rudimentary papillae; gill filaments long as eye.

Scales 75 in lateral line, from above gill opening to caudal base and 23 more out over caudal medially; 23 above, 28 below, 17 obliquely down from lower eye to gill opening. Vertical fins all largely scaly. Dextral scales with 9 to 11 long slender apical denticles, with 3 or 4 series transversely smaller basally; 11 or 12 basal radiating striae; circuli fine, apparently obsolete apically. Sinistral scales similar.

D. 72, fin height  $1\frac{3}{4}$  in head; A. 59, fin height  $1\frac{3}{4}$ ; caudal  $1\frac{1}{4}$ , convex behind; pectoral long as eye; ventral 3 in head.

Right side gray brown, with muzzle brown until level with middle of eyes when bordered transversely with black line; 12 pairs of narrow parallel blackish transverse bands which extend on dorsal and anal to their edges. Caudal whitish terminally, with black subbasal band and another submarginal, with some blackish horizontal lines along fin rays. Left side buff, vertical fins all gray and submarginally blackish, also tail posteriorly soiled with dark gray. Iris gray.

One, 124 mm. Differs a little from *Zebrias zebra* (Bloch) as there are no horizontal dark bars along the front of the head or muzzle. Also last dorsal ray only half joined by basal membrane with caudal, and last anal ray entirely free from caudal in the above specimen. Not previously reported from Natal.

### CYNOGLOSSIDAE

*Cynoglossus durbanensis* Regan. Figure 10.

Depth  $4\frac{1}{4}$ ; head  $5\frac{1}{2}$ , width  $3\frac{1}{2}$ . Snout  $2\frac{1}{2}$  in head measured to lower eye; lower eye  $8\frac{1}{2}$ ,  $3\frac{1}{2}$  in snout; mouth cleft curved, reaches  $\frac{3}{4}$  in lower eye, length from front end of mandible 4 in head; rictus little nearer snout tip than hind edge of gill opening; narrow interorbital  $\frac{1}{2}$  of lower eye. No gill rakers. Gill filaments  $\frac{1}{2}$  of snout.

Scales 99 in lateral line to caudal base, of which 9 before hind edge of gill opening; 20 above to upper lateral line, 26 below to anal base; dorsal and anal sinistrally with well-defined basal area 4 scales deep, dextrally naked. Caudal finely scaled basally. Sinistral scales with 17 to 20 long apical spinules, basally 6 to 8 transverse series of elements; 25 to 28 radiating basal striae; circuli basal, apparently not extended apically. Dextral scales similar. No dextral lateral line.

D. 100, fin height  $2\frac{3}{4}$  in head; A. 82, fin height  $2\frac{2}{3}$ ; caudal length 2; ventral  $2\frac{1}{2}$ .

Left side brown, with 7 obscurely defined blackish transverse bands and along edges of back alternating dark brown blotches of much smaller extent. Whole region of interspaces with dark brown bars and spots or mottling. Vertical fins with paler ground color and finely spotted irregularly with dark brown. On lower posterior half of head transverse black blotch. Iris gray. Right side pale brownish, dark spots on vertical fins showing through grayish.

One, 171 mm.

*Areliscus marleyi* (Regan).

Depth  $4\frac{1}{2}$ ; head  $4\frac{1}{2}$ , width  $3\frac{1}{2}$ . Snout  $2\frac{1}{2}$  in head to lower eye; lower eye 9, 4 in snout; mouth cleft, curved, extends half an eye diameter behind eye, length from front end of mandible 5 in head; rictus eye diameter nearer gill opening than snout tip; interorbital narrow,  $\frac{1}{3}$  of eye, concave; nostril in tube on upper lip level with front edge of upper eye; hind nostril simple pore at middle in front of interorbital. Gill rakers as row of about 15 rudimentary papillae; gill filaments  $1\frac{1}{2}$  times eye diameter.

Scales 117 in median lateral line to caudal base, of which 12 before hind edge of gill opening; 19 above to upper lateral line, 20 below to lower lateral line; no lateral line on right side. Basal half of vertical fins scaly on both sides. Scales of sinistral side with 14 or 15 rather long apical spinules, basally 5 transverse series of elements; 24 or 25 radiating basal striae; circuli fine, not distinct apically. Dextral scales with 11 apical spinules and 3 transverse series of basal elements; 25 or 26 basal radiating striae; circuli fine, none apical.

D. 126, fin height  $2\frac{1}{3}$  in head; A. 100, fin height  $2\frac{2}{3}$ ; caudal 3.

Left side brown. Eyes gray. Vertical fins broadly blackish submarginally, though better contrasted on left side due to sharply defined basal scaly area. On right side entire area of vertical fins dark or blackish brown. Inside gill opening black.

One, 310 mm.

### ZEIDAE

#### *Zeus faber* Linnaeus.

One 446 mm. Compared with Barnard's figure of *Zeus capensis* this specimen shows the large black lateral ocellus divided evenly by the lateral line. This is in entire agreement with Italian specimens of *Z. faber* before me, though all the latter smaller. The Italian material further differs in much more spiny bucklers or the spines greatly enlarged and conspicuous.

### GRAMMICOLEPIDAE

#### *Xenolepidichthys dalgleishi* Gilchrist.

Depth  $1\frac{1}{5}$ ; head  $3\frac{1}{3}$ , width 2. Snout  $3\frac{1}{4}$  in head, eye  $2\frac{1}{10}$ , greatly exceeds snout or interorbital; maxillary short, reaches  $\frac{2}{3}$  to front of eye, length 4 in head; lower jaw very slightly protrudes; interorbital 3, broadly convex. Gill rakers 11, short, flexible, papillate points,  $\frac{1}{3}$  of gill filaments, which  $\frac{1}{3}$  of eye.

Scales slender, vertically elongate, linear, of narrow "dove-tailed" appearance, each with 5 or 6 fine, smooth, parallel, vertical keels; about 80 in lateral line to caudal base and 6 more on latter; 3 above, 10 below, 3 rows on cheeks to lower preopercular ridge. Ridge above each nostril and over eye minutely serrulate; row of minute serrae on preopercular ridge and another on edge. Lateral line greatly arched or ascending to upper fifth in body depth anteriorly, becomes median and axial slightly behind middle in space between gill opening and caudal base.

D. V, 29, first spine minute, second  $1\frac{2}{3}$  in head and with 2 rows of spinules on front edge and 1 along each side, soft fin height  $1\frac{1}{3}$  in head; A. II, 27, first spine  $2\frac{1}{3}$  and with 2 irregular rows of spinules along front edge and 1 along each side posteriorly; bases of dorsal and anal with row of short spines along each side, with one spine opposite base of each ray; caudal  $1\frac{1}{2}$ , emarginate behind; least depth of caudal peduncle  $4\frac{1}{4}$ ; pectoral  $1\frac{2}{3}$ , rays 1, 14; ventral rays 1, 6, fin  $2\frac{1}{2}$  in head.

Generally pale brown, with silvery tints. Upper edge of back and caudal peduncle brownish. Sides and back with scattered, diffuse, brownish spots about size of pupil, and irregularly arranged in 5 or 6 series as counted

transversely or longitudinally. Iris gray. Spinous dorsal slate black terminally. Caudal pale or whitish, bordered blackish behind. Fins otherwise whitish.

One, 92 mm.

### TRACHICHTHYIDAE

#### *Trachichthodes spinosus* Gilchrist.

Depth  $2\frac{1}{10}$ ; head  $2\frac{1}{2}$ , width  $1\frac{1}{2}$ . Snout 5 in head; eye  $2\frac{1}{2}$ , greatly exceeds snout or interorbital; maxillary reaches opposite hind eye edge, expansion  $1\frac{1}{2}$  in eye, length  $1\frac{1}{2}$  in head; bands of low, even teeth in jaws, with external cluster each side of mandibular symphysis; band of close set, granular teeth on each palatine and vomer; interorbital  $3\frac{1}{2}$ , convex. Two short spines at preopercular angle, lower shorter and broader. Gill rakers  $14 + 20$ , slender, lanceolate,  $1\frac{1}{2}$  in eye; gill filaments  $\frac{3}{2}$  of gill rakers.

Scales  $43 + 3$  in lateral line; 8 above, 15 below, 36 predorsal, extend forward  $\frac{1}{2}$  of eye; 6 on cheek behind hind maxillary end. Dorsals and anals in basal scaly sheaths. Scales with 26 to 28 marginal apical denticles; apical surfaces with scattered pores; circuli very fine, not extended apically. Lateral line axial, complete, of small simple tubes, little exposed, this due to notch in overlapping scale.

D. VI, 15, 1, last spine  $2\frac{1}{2}$  in head, second ray  $1\frac{1}{2}$ ; A. IV, 16, 1, first branched ray  $2\frac{1}{10}$ ; caudal  $1\frac{1}{2}$ , forked, lobes rounded; least depth of caudal peduncle 3; pectoral  $1\frac{1}{4}$ , rays II, 11; ventral rays I, 7, fin  $1\frac{3}{4}$  in head.

Uniform pale brownish. Iris gray.

One, 192 mm.

#### *Gephyroberyx darwini* (Johnson).

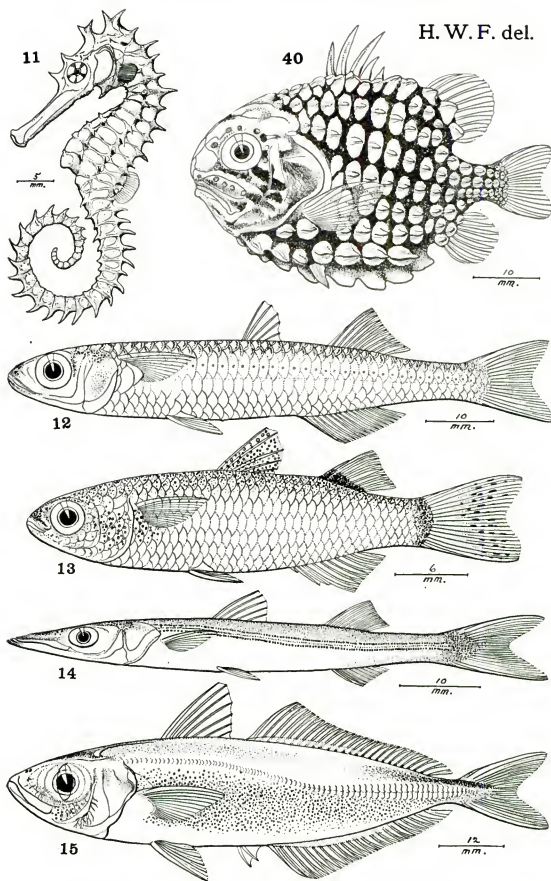
Depth  $2\frac{1}{10}$ ; head  $2\frac{1}{2}$ , width  $2\frac{1}{2}$ . Snout  $3\frac{1}{2}$  in head from snout tip; eye  $3\frac{1}{2}$ , subequal with snout,  $1\frac{1}{10}$  in interorbital; maxillary reaches  $\frac{3}{4}$  in eye, expansion  $1\frac{1}{2}$ , length  $1\frac{1}{2}$  in head from snout tip; teeth fine, in villiform bands in jaws, on vomer and palatines, those of upper jaw and maxillary mostly exposed; interorbital  $3\frac{1}{2}$ , convex; opercle with strongly marked radiating striae, with moderate spine behind about level with lower eye edge; rather large, strong spine at lower preopercular angle, its edge with irregular spinules. Gill rakers  $7 + 14$ , lanceolate,  $1\frac{1}{2}$  in eye or twice gill filaments.

Scales about  $75 + 7$ , irregular, rough velvety to touch along lateral line; pores  $27 + 3$  in lateral line; 12 irregular scales above lateral line, about 15 below; 8 horizontally on cheek from behind maxillary expansion to angle of preopercular ridge. Scales with 14 to 16 series irregularly of spinules vertically and 4 or 5 horizontally medially, on apical portion; 10 to 12 circuli basally (transversely). Lateral line axial, complete, median to caudal base. Rough scaly predorsal forward until opposite hind pupil edge. Postventral scutes 11 and 2 more behind vent.

D. VIII, 13, 1, third spine  $3\frac{1}{2}$  in total head length, third branched ray 2; A. III, 11, 1, second branched ray  $2\frac{1}{2}$ ; caudal  $1\frac{1}{2}$ , deeply forked, 7 spinescent rudimentary rays both above and below; least depth of caudal peduncle  $4\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$ , rays II, 12; ventral rays I, 6, fin  $1\frac{1}{2}$ , spine  $\frac{2}{3}$  of fin.

Head and body largely uniform gray. Iris darker gray. Fins whitish.

One, 130 mm. Barnard wrongly credits this fish to Lowe, who was unacquainted with it.



11. *Hippocampus histrix*.  
 13. *Mugil ramada*.  
 15. *Trachurops mauritanus*.

12. *Atherina afra*.  
 14. *Sphyræna acutipinnis*.  
 40. *Monocentris japonicus*.

**HOLOCENTRIDAE**

*Holocentrus diadema* Lacépède.

One, 134 mm.

**MONOCENTRIDAE**

*Monocentris japonicus* (Houttuyn). Figure 40.

One, 56 mm. "Bright yellow with black."

**SYNGNATHIDAE**

*Syngnathus temminckii* Kaup.

Two, 150 to 194 mm. Snout  $1\frac{3}{4}$  in rest of head. Brood pouch on 1 + 23 rings. D. 32, on 2 + 7 rings.

*Hippocampus kuda* Bleeker.

One, 150 mm.

*Hippocampus histrix* Kaup. Figure 11.

One, 130 mm. Not previously reported from Natal.

**FISTULARIIDAE**

*Fistularia petimba* Lacépède.

One, 585 mm.

**MACRORHAMPHOSIDAE**

*Macrorhamphosus velitaris* (Pallas).

Depth  $4\frac{3}{8}$ ; head  $2\frac{1}{8}$ , width 5. Snout  $1\frac{3}{8}$  in head from snout tip; eye 6,  $3\frac{3}{8}$  in snout, greater than interorbital,  $1\frac{1}{8}$  in postorbital; maxillary length  $1\frac{3}{8}$  in eye; interorbital  $6\frac{1}{2}$ , low, convex. Gill rakers 3 + 10, finely lanceolate, about  $\frac{1}{4}$  of gill filaments, which  $1\frac{2}{3}$  in eye.

Scales about 52 + 3 in lateral median series from head; 32 transversely from dorsal spine. Three oblique suprascapular keels on postocular keeled ridge.

D. V — 10, second spine largest, inserted eye diameter in advance of anal or opposite tips of depressed ventrals, reaches middle of soft dorsal base, length  $2\frac{1}{8}$  in total head; soft dorsal height  $2\frac{1}{8}$  in spine; A. 18, fin height  $4\frac{1}{2}$  in second dorsal spine; least depth of caudal peduncle  $8\frac{1}{2}$  in total head length; caudal  $3\frac{1}{8}$ , little emarginate; pectoral 3, rays about 10; ventral length 8 in head.

Dark brown to slate above, more brownish below, lower edge of head and belly much paler to whitish. Lower sides of head with dark gray spots, all close set. Iris gray. Fins all light brown, bases dark.

One, 52 mm. Washed ashore at Durban. "Back steel blue, belly pale claret to silvery."

*Notopogon natalensis* (Gilchrist).

One, 175 mm. Base of second dorsal spine directly over soft dorsal origin.

## ATHERINIDAE

*Atherina afra* Peters. Figure 12.

Depth  $5\frac{3}{4}$ ; head  $4\frac{1}{8}$ , width 2. Snout  $3\frac{3}{4}$  in head from snout tip; eye 3, greater than snout, equals interorbital; maxillary reaches  $\frac{1}{10}$  in eye, length  $2\frac{1}{2}$  in head from snout tip; mandibular rami little elevated posteriorly inside mouth; teeth minute, in narrow bands in jaws, on vomer and palatines; interorbital 3, low, level. Gill rakers  $6 + 18$ , slender, lanceolate, 2 in eye; gill filaments  $\frac{7}{8}$  of gill rakers.

Scales  $37 + 3$  in median lateral series from pectoral origin; 7 transversely from second dorsal origin to anal origin; 17 predorsal forward to occiput; 5 behind depressed first dorsal to second dorsal origin. Lateral line as row of axial pores, one on each scale exposure from end of depressed pectoral to caudal base. Scales with median marginal basal point, often another less distinct each side; circuli 20 to 22, basal, none apical.

D. V—I, 10, 1, third spine 3 in total head length, second branched ray  $2\frac{1}{2}$ ; A. I, 13, 1, first branched ray  $2\frac{1}{2}$ ; caudal  $1\frac{1}{10}$ , emarginate; least depth of caudal peduncle  $2\frac{2}{3}$  in its length or  $3\frac{1}{2}$  in total head length; pectoral  $1\frac{3}{8}$ , rays 1, 15; ventral rays I, 5, fin  $1\frac{1}{8}$  in total head length. Vent at ends of depressed ventrals.

Body pale greenish brown, each scale on back with marginal row of blackish dots. Side with brown band (evidently silvery white in life) from pectoral to caudal base, its width  $\frac{2}{3}$  eye diameter. Iris gray (evidently silvery white in life). Fins all pale. End of snout and front edges of mandible with blackish brown.

Length 79 mm. Durban beach 1931. New for Natal.

*Hepsetia pinguis* (Lacépède).

One, 85 mm. Durban beach, 1931.

## MUGILIDAE

*Mugil ramada* Risso. Figure 13.

One, 39 mm. Durban beach, 1931.

*Mugil auratus* Risso.

One, 275 mm. No adipose eyelids. Scales 48 in lateral series to caudal base. A. III, 9, 1. Pectoral  $1\frac{1}{3}$  in head.

*Mugil macrolepis* Andrew Smith.

One, 208 mm. Eye 4 in head, equals snout in profile,  $1\frac{3}{4}$  in interorbital; adipose eyelids narrow. Scales 34 in lateral series to caudal base. A. III, 9, 1. Pectoral  $1\frac{1}{8}$  in head, without axillary scale.

## SPHYRAENIDAE

*Sphyraena acutipinnis* Day. Figure 14.

One, 67 mm. Washed on ocean beach, Durban, Nov. 10, 1933. Lateral line with about 90 scales to caudal base.

***Sphyaena obtusata* Cuvier.**

Two, 148 to 250 mm. Scales 75 to 78 + 6.

**POLYNEMIDAE*****Polydactylus plebeius* (Broussonet).**

Two, 178 to 518 mm. Larger from Lake St. Lucie Estuary, Zululand. Pectoral filaments 5.

**SCOMBRIDAE*****Scomber gigas*, new species. Figure 16.**

Depth  $4\frac{1}{2}$  to  $4\frac{3}{4}$ , head  $3\frac{3}{8}$  to  $3\frac{3}{4}$ , width  $1\frac{3}{4}$  to  $1\frac{1}{2}$ . Snout  $2\frac{1}{2}$  to  $3\frac{1}{2}$  in head; eye  $4\frac{1}{2}$  to 5,  $1\frac{1}{3}$  to  $1\frac{1}{2}$  in snout,  $1\frac{1}{2}$  to  $1\frac{3}{4}$  in interorbital, adipose eyelids broad, thick, gelatinous; maxillary concealed by broad preorbital, reaches  $\frac{1}{2}$  to  $\frac{1}{3}$  in eye, length  $2\frac{3}{4}$  to  $2\frac{1}{2}$  in head; teeth not evident; mandible  $1\frac{9}{10}$  to 2; interorbital  $3\frac{1}{2}$  to  $3\frac{3}{4}$ , convex. Gill rakers 10 + 31, lanceolate, equal gill filaments or  $1\frac{1}{2}$  times eye.

Scales about 140 along lateral line to caudal base; 16 above to spinous dorsal origin, 22 below to anal origin, 30 predorsal forward about  $\frac{3}{4}$  of postocular region of head. Some scales over base of pectoral rather well exposed and enlarged as if forming rudimentary corselet; similarly some below and behind pectoral base. Rather large, linear, horizontal scales on cheek, veiled with membrane of adipose eyelids. Soft vertical fins covered with small, densely crowded scales.

D. IX — I, 11 + 5, second spine  $1\frac{1}{2}$  to 2 in total head length, second branched ray  $3\frac{1}{2}$  to 5, depressed spinous dorsal 2 to  $2\frac{1}{2}$  to soft dorsal origin; A. I, 11 + 5, second branched ray  $4\frac{2}{3}$  to  $4\frac{3}{4}$  in total head length; caudal  $1\frac{1}{4}$  to  $1\frac{3}{4}$ , deeply and triangularly emarginate; least depth of caudal peduncle  $6\frac{1}{2}$  to 8; pectoral 2 to  $2\frac{1}{4}$ , rays 1, 16; ventral rays I, 5, fin  $2\frac{1}{2}$  to  $2\frac{1}{2}$  in head.

Back and head above olive to slate gray, lower half of head and body light brownish, evidently silvery white in life. Line of demarcation along sides not abrupt, with obscure grayish mottling leaving close-set numerous pale spots. Iris grayish. End of mandible deep gray brown, also groove from concealed maxillary. Spinous dorsal dark gray. Soft dorsal and caudal dull olive, other fins whitish. Inside of pectoral basally dark gray.

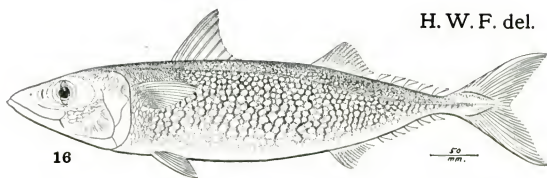
A.N.S.P., No. 25844. Durban, Natal. Length 635 mm. Type. Also A.N.S.P., No. 25872, same data, paratype. Length 585 mm.

In its reduced dorsal spines and the number of its lower gill rakers, the present species is affiliated with *Scomber colias*. It may be distinguished, however, by its much larger scales, which exceed 200 in a lateral series in *S. colias*. Moreover its squamation is different and the scales above the pectoral are somewhat enlarged or suggestive of a rudimentary corselet. *S. chrysozonus* Rüppell 1835, also a large scaled species, has but 21 to 23 lower gill rakers as my Sumatran and Formosan materials showed.

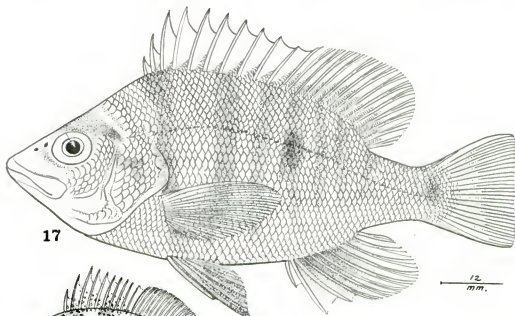
Two, 102 to 107 mm. Durban Beach, 1931. These are apparently young, as one shows 31 lower gill rakers and rather large scales. They do not have the scales enlarged above or below the pectoral.



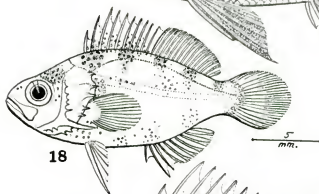
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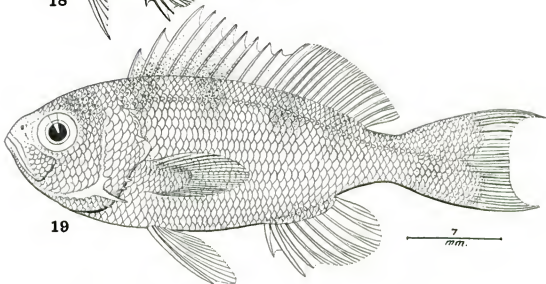
16

10  
mm.

17

12  
mm.

18

5  
mm.

19

7  
mm.

16. *Scomber gigas*. 17. *Paracentropistis scriba*.  
18, 19. *Planctanthias preopercularis*.

*Scomber gigas* reaches a greater size than any known species of its genus, and is known by its contrasted scale structure in combination with its other characters. The presence of a well developed air bladder places it definitely in the subgenus *Pneumatophorus* Jordan and Gilbert.

(γίγας giant.)

***Scomber colias* Gmelin.**

One, 208 mm. Lower gill rakers 28. Scales about 185 in lateral series, 17 above, 39 predorsal.

***Rastrelliger kanagurta* (Rüppell).**

One, 180 mm. Agrees with my series of Indian and Siamese specimens.

Gilchrist and Thompson 1917, following usage at that time, perpetuated the confusion of this species with *Scomber chrysozonus* Rüppell. They are followed by Barnard who calls the species "*Restrelliger microlepidotus* Rüpp." or the "Striped Mackerel."

***Scomberomorus commerson* (Lacépède).**

One, 292 mm. About 3 rows of darker brown spots, all less than the eye in size and lowest row most distinct and axial. Anterior half and entire edge of first dorsal black, rest of fin white.

## NOMEIDAE

***Nomeus albula* (Meuschen).**

One, 48 mm. McCulloch 1929 adopted the present name of the species from *Gobius albula* Meuschen 1781 thus replacing *G. gronovii* Gmelin 1789 of later date.

## CARANGIDAE

***Seriola bonariensis* Valenciennes.**

Depth 3; head  $3\frac{1}{2}$ , width 2. Snout  $2\frac{1}{2}$  in head; eye 5,  $1\frac{1}{2}$  in snout,  $1\frac{3}{4}$  in interorbital; maxillary reaches  $\frac{1}{4}$  in eye, expansion  $1\frac{1}{2}$  in eye, length  $2\frac{2}{3}$  in head; teeth in broad villiform bands in jaws, on vomer and palatines; interorbital  $3\frac{1}{10}$ , convex; opercle striate along front edge and above. Gill rakers  $7 + 19$ , lanceolate,  $1\frac{1}{2}$  in eye or subequal with gill filaments.

Scales  $120 + 8$  in lateral line; 24 above, 33 below, 27 predorsal; 14 across cheeks to lower angle of preopercle ridge. Scales with 8 or 9 basal radiating striae; circuli moderate, complete. Lateral line broadly arched, falls median on tail posteriorly.

D. I, VII, I, 28, I, fourth erect spine 5 in head, second branched ray  $1\frac{3}{4}$ ; A. II — I, 19, I, second branched ray  $1\frac{3}{4}$ ; caudal  $1\frac{1}{2}$ , deeply emarginate; least depth of caudal peduncle  $4\frac{3}{4}$ ; pectoral  $1\frac{1}{2}$ , rays II, 18; ventral I, 5, fin  $1\frac{1}{2}$  in head.

Largely uniform brown, little paler on under surface of head, breast and belly. Iris gray. Soft dorsal, anal and caudal dark brown. Spinous dorsal pale. Broad dark brown band from upper hind eye edge toward origin of spinous dorsal. Pectoral pale brown. Ventral dark brown, front edge pale.

One, 364 mm. "Greenish, with broad band of pale green running through center of body. Oblique band of dark green extending from upper eye to spinous dorsal. Over head below eye to upper part of opercle, pale maroon. Fin rays dark green, lighter in pectorals and ventrals."

**Trachurops mauritianus** (Quoy and Gaimard). Figure 15.

Two, 93 to 100 mm. Durban beach, 1931. Head  $3\frac{1}{4}$  to  $3\frac{3}{4}$ ; depth  $4\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$  to  $1\frac{3}{4}$  in head or reaches half way to beginning of straight section of lateral line. Compared with 5 Porto Rican specimens of *T. crumenophthalmus* (Bloch), 125 to 129 mm., the above characters are: Head  $3\frac{1}{2}$  to  $3\frac{3}{4}$ ; depth  $3\frac{3}{4}$  to  $3\frac{5}{8}$ ; pectoral  $1\frac{1}{2}$  to  $1\frac{1}{4}$  in head, reach  $1\frac{1}{2}$  to  $1\frac{3}{4}$  to base of straight section of lateral line.

*Caranx mauritianus* Quoy and Gaimard was based on a specimen 100 mm. long, its depth 10 lines which would compute as  $4\frac{1}{2}$  ( $4\frac{1}{2}$  to  $5\frac{1}{2}$  in my specimens including caudal). Sauvage 1891 gives Quoy and Gaimard's type with the depth  $4\frac{1}{2}$  and head nearly 4 in the total length. Wakiya 1924 figures *Selar mauritianus* from Kii on a specimen 140 mm. long to its caudal base, showing: Depth  $3\frac{3}{4}$ ; head  $3\frac{1}{2}$ ; pectoral long as head or reaches  $1\frac{1}{2}$  to beginning of straight section of lateral line. Surely this is not *Caranx mauritianus* Quoy and Gaimard.

**Megalaspis cordyla** (Linnaeus).

One, 200 mm.

**Carangoides gymnostethoides** Bleeker.

One, 165 mm. Apparently like Oceania materials, and Jordan and Evermann's Hawaiian figure of *Carangoides ferdau* 1905. My specimen shows its snout tip level with its lower eye edge and similar proportions of fins, the vertical ones pale greenish. It is also with 6 transverse vertical dark gray bands, not inclined slightly forward as in Wakiya's figure of *Caranx* (*Carangoides*) *ferdau*. The small, blackish, submarginal opercular spot is also distinct in my specimen. Not previously reported from South Africa.

**Atropus atropus** (Schneider).

One, 114 mm. Durban, Jan. 2, 1933.

**Hypacantus amia** (Linnaeus).

One, 373 mm. "Bluish gray, darker on back and in rays of fins. Caudal lobes dark red half way. Caught in Durban Bay."

**Parastromateus niger** (Bloch).

One, 511 mm. "General colour pale brownish mixed with light gray, darker on back and fading much lighter on belly. Scales marked with a pale violet dot. Black crescentic mark on cheek. Lips mauve pink. Fins edged black. Durban beach nets. Appears white when swimming."

**MENIDAE*****Mene maculata*** (Schneider).

One, 140 mm. An interesting addition to the South African fauna. Known in the Indian Ocean from Arabia, Zanzibar, Madagascar, India, Ceylon and the East Indies.

**LEIOGNATHIDAE*****Gazza equulaeformis*** Rüppell.

Two, 92 to 95 mm. Depth  $2\frac{2}{3}$  to  $2\frac{1}{2}$ .

**CHANDIDAE*****Ambassis natalensis*** Gilchrist and Thompson.

One, 146 mm.

**AMIIDAE*****Amia frenata*** Valenciennes.

Four, 92 to 128 mm.

***Amia gardineri*** (Regan).

Depth  $2\frac{1}{2}$ ; head  $2\frac{1}{2}$ , width 2. Snout 4 in head from snout tip; eye  $3\frac{3}{4}$ , greatly exceeds snout or interorbital; maxillary reaches  $\frac{1}{2}$  in eye, expansion  $1\frac{1}{2}$  in eye, length 2 in head from snout tip; upper teeth in villiform bands, about 7 irregularly transverse, also small bands on vomer and palatines; mandibular teeth biserial on sides of jaws; interorbital 4 in head from snout tip, low, slightly convex; preopercular ridge entire, edge finely serrate. Gill rakers  $5 + 13$ , lanceolate,  $1\frac{3}{4}$  in eye; gill filaments  $\frac{3}{4}$  gill rakers.

Scales  $24 + 2$  in lateral line; 3 above, 7 below; predorsal region with 4 forward each side opposite hind or vertical preopercular ridge and whole area with 8 or 9 large longitudinal mucous wrinkles; 2 rows of scales on cheek. Supra-scapular edge minutely denticulate. Scales with 11 to 21 basal radiating striae; 148 to 150 apical denticles, with 1 to 3 series of basal elements; circuli fine, basal. Lateral line axial along side of body, complete.

D. VII — I, 9, 1, third spine  $1\frac{1}{2}$  in total head length, second branched ray  $1\frac{1}{2}$ ; A. II, 8, 1, second spine 3, second ray  $1\frac{1}{2}$ ; caudal  $1\frac{1}{2}$ , nearly truncate, only very slight emargination behind as expanded; least depth of caudal peduncle  $3\frac{1}{10}$ ; pectoral  $1\frac{1}{2}$ , rays II, 13; ventral rays I, 5, fin  $1\frac{2}{3}$  in head, spine  $1\frac{1}{2}$  in fin.

Dull brown generally, under surfaces scarcely paler. Iris gray. Under lens most all of body seen with fine, minute, close-set dark brown dots or specks. Blackish transverse band from front of spinous dorsal to middle of postventral space; second blackish band from middle of second dorsal base to middle of anal base; third transversely at caudal base. On middle of caudal peduncle obscure dark transverse band between 2 black ones of dorsal and caudal bases. Dorsals brownish, membranes marginally at apex of fin blackish. Soft dorsal, anal and ventrals dark brown, last slate black terminally; second blackish body band reflected on second dorsal and anal basally. Caudal brown, paler basally. Pectoral pale brown, with obscure dark basal blotch.

One, 118 mm. Originally described as *Apogon gardineri* Regan from an example 50 mm. long, obtained at Cargados Carajos, Indian Ocean. It was said to be allied with *A. bandanensis* Bleeker, with which Fowler and Bean have wrongly identified it.

***Amia natalensis*** Gilchrist and Thompson.

Depth  $2\frac{3}{8}$  to  $2\frac{3}{4}$ ; head  $2\frac{3}{8}$  to  $2\frac{3}{4}$ , width  $1\frac{1}{2}$  to 2. Snout  $3\frac{3}{4}$  to 4 in head from snout tip; eye  $3\frac{3}{4}$  to 4, 1 to  $1\frac{1}{6}$  in snout, equals interorbital; maxillary reaches  $\frac{1}{2}$  to  $\frac{2}{3}$  in eye, expansion  $1\frac{3}{8}$  to  $1\frac{1}{4}$ , length 2 to  $2\frac{1}{5}$  in head from snout tip; teeth in villiform bands in jaws, on vomer and palatines, on first in 8 to 10 series transversely; interorbital  $3\frac{1}{2}$  to 4, low, convex; preopercular ridge entire, edge minutely serrate. Gill rakers  $5 + 16$ , slender, clavate,  $2\frac{1}{2}$  in eye or subequal with gill filaments.

Scales  $36 + 5$  in lateral line; 4 above, 12 below, 4 predorsal scales, though most of predorsal region spongy and soft, very porous; 4 rows of scales on cheek. Scales with 18 to 22 basal radiating striae; 107 to 124 apical denticles, with about 1 to 8 transverse series of basal elements; circuli fine, basal. Lateral line complete, little high at first, axial.

D. VII — I, 9, third spine  $2\frac{1}{10}$  to  $2\frac{1}{5}$  in total head length, second branched ray  $1\frac{1}{4}$  to 2; A. II, 8, second branched ray  $1\frac{1}{4}$  to 2; caudal  $1\frac{1}{4}$  to  $1\frac{1}{3}$ , slightly emarginate behind; least depth of caudal peduncle  $2\frac{1}{4}$  to  $2\frac{1}{3}$ ; pectoral  $1\frac{3}{8}$  to  $1\frac{3}{5}$ , rays II, 12; ventral I, 5, fin  $1\frac{1}{8}$  to  $1\frac{1}{5}$  in total head.

Brown, with 5 or 6 longitudinal dark brown lines following scale junctures above lateral line, below 13 similar bands, all horizontal. Iris gray. Spinous dorsal blackish. Pectoral base broadly black, fins otherwise light brown.

Three, 148 to 188 mm. "Lake, with olive lines passing through body."

***Amia queketti*** (Gilchrist).

One, 42 mm., Natal bluff, May 5, 1932.

***Archamia lineolata*** (Cuvier).

Two, 56 to 106 mm.

***Epigonus telescopus*** (Risso).

Depth  $3\frac{3}{8}$ ; head 3, width  $1\frac{1}{4}$ . Snout  $3\frac{3}{4}$  in head from upper jaw tip; eye 3, greater than snout or interorbital; maxillary reaches  $\frac{1}{2}$  in eye, expansion 3, length 2 in head from snout tip; teeth rather large, slender, compressed, well spaced, sharply pointed, uniserial in jaws, with row of 4 transversely above anteriorly of which 2 median largest; row of smaller teeth on each palatine and patch on vomer; interorbital  $3\frac{3}{8}$ , broadly concave. Gill rakers  $9 + 17$ , of which 5 or 6 both above and below rudimentary, length equals gill filaments, which  $3\frac{1}{4}$  in eye.

Scales  $50 + 5$  in lateral line; 7 above, 12 below; 55 predorsal forward to front end of snout, of which 10 forward to occiput opposite hind preopercle edge; 6 rows of scales on cheek to preopercle ridge and 6 more over to hind preopercle edge. All fins but spinous dorsal more or less finely scaled. Scales very caducous, most all having fallen from body. Lateral line rather high at first, conspicuous, slopes back until median at caudal base.

D. VIII — I, 12, 1, third spine  $2\frac{1}{2}$  in total head, first branched ray  $2\frac{3}{4}$ ; A. II, 12, 1, first branched ray  $2\frac{3}{4}$ ; caudal  $1\frac{3}{4}$ , deeply forked, slender lobes sharply pointed; least depth of caudal peduncle  $3\frac{1}{2}$ ; pectoral 2, rays II, 14; ventral rays I, 5, fin  $2\frac{1}{2}$  in total head length.

Dark brown generally, where scales have fallen edges dusky and generally denuded areas drab. Iris gray. Fins all dark brown. Inside gill opening blackish brown.

One, 382 mm. "Pale pink, mixed with silvery. Caught by line and hook on Natal coast."

### DULEIDAE

*Dules taeniurus* Cuvier.

One, 164 mm.

### SERRANIDAE

*Aulacocephalus temmincki* Bleeker.

One, 248 mm. "Back black, with a bright yellow band through body. Below mauve pink. Fin rays maroon, fin membranes smoky blue."

*Cephalopholis miniatus* (Forskål).

One, 221 mm.

*Serranus morrhua* (Valenciennes).

One, 272 mm.

*Serranus andersoni* (Boulenger).

Depth  $3\frac{1}{2}$ ; head  $2\frac{1}{2}$ , width  $2\frac{1}{2}$ . Snout  $4\frac{1}{2}$  in head from snout tip; eye 6,  $1\frac{1}{2}$  in snout, 1 in interorbital; maxillary reaches very slightly beyond hind eye edge, expansion  $1\frac{3}{4}$  in eye, length  $2\frac{1}{2}$  in head from snout tip; teeth in bands in jaws, outer upper row little enlarged and lower lateral teeth biserial; fine teeth on vomer and palatines; interorbital 7, low, nearly level; hind preopercle edge denticulate, with serrae becoming larger below. Gill rakers  $9 + 15$ , of which 6 of upper rudimentary tubercles, longest  $1\frac{1}{2}$  in gill filaments or 2 in eye.

Scales 85 in lateral line to caudal base; pores  $52 + 8$  in lateral line; 20 scales above lateral line, 34 below, 58 predorsal forward to front end of snout; 24 scales obliquely across cheek to hind angle of preopercle ridge and 8 more across flange. Scales with 5 basal radiating striae; circuli fine, basal, obsolete apically. Lateral line axial along side to caudal base medianly.

D. XI, 14, 1, fourth spine  $3\frac{1}{2}$  in total head length, seventh ray  $2\frac{1}{2}$ ; A. III, 8, 1, third spine  $3\frac{3}{4}$ , fifth ray  $2\frac{1}{4}$ ; caudal  $1\frac{3}{4}$ , rounded behind; least depth of caudal peduncle  $3\frac{1}{2}$ ; pectoral  $1\frac{3}{4}$ , rays I, 17; ventral rays I, 5, fin  $2\frac{1}{2}$  in total head length.

Brown, pale to whitish on under surface of head, breast and belly. Body, dorsal and caudal marked with rather large blackish spots about size of pupil, as 2 rows above lateral line and 5 below, 3 rows on dorsals and 4 transversely on caudal. Blackish brown streak from hind eye edge toward pectoral origin, another lower across cheek to angle of preopercular ridge

and third over upper edge of maxillary. Iris gray. Fins all more or less brownish, ventrals and anal rather uniformly dark and pectorals pale.

One, 252 mm.

**Serranus fasciatus** (Forskål).

One, 178 mm.

**Serranus caeruleo-punctatus** (Bloch).

One, 236 mm.

**Acanthistius sebastoides** (Castelnau).

Three, 106 to 210 mm. Smallest from stomach of deep-sea fish from off Natal.

**Paracentropristis scriba** (Linnaeus). Figure 17.

One, 94 mm. Not previously reported from Natal. In West Africa known from Morocco to Senegambia.

#### **PLANCTANTHIAS**, new genus.

Body elongate ovoid, compressed. Head moderate, compressed, obtuse. Snout short, blunt. Eye rather large, little high, little advanced in head. Maxillary reaches below eye, expanded behind. Teeth small, in single series in each jaw, with pair of wide-set, slightly larger canines in front, both above and below anteriorly. Interorbital rather broadly convex. Preopercle with spine at angle, edges above and below denticulate. Opercle with 2 spines. Spine at beginning of lateral line close below first scale. Lower edge of gill opening with some denticles. Suprascapula with one or more small denticles. Gill openings wide, membranes separate and free from isthmus. Gill rakers lanceolate. Scales ctenoid, rough to touch, in series parallel with lateral line above its course, below in horizontal series. Soft vertical fins scaly basally. Lateral line well arched, continuous to caudal. Dorsals continuous, spines well developed and edges of membranes deeply notched. Second anal spine largest and rather long, rayed fin short. Caudal little emarginate behind, ends pointed. Caudal peduncle rather short, deep and compressed. Pectoral rather large, reaches anal. Ventral inserted behind pectoral base, with rather long spine. Coloration pale, little contrasted.

Type *Planctanthias praepercularis*, new species.

A member of the Anthiinae and like *Anthias* Bloch, but differs in its physiognomy, long preopercular spine, and the larger and fewer spines on the preopercle edges, and along the gill opening.

<sup>11</sup> (πλαγκτόν plankton + *Anthias*; with reference to its association with the minute animals and plants, or plankton, that float passively in the water.)

**Planctanthias praepercularis**, new species. Figures 18 (young) and 19 (adult, type).

Depth  $2\frac{1}{2}$  to  $2\frac{3}{4}$ ; head  $2\frac{1}{2}$  to 3, width  $2\frac{1}{3}$  to  $2\frac{2}{3}$ . Snout 4 to  $4\frac{1}{4}$  in head from snout tip; eye 3 to  $3\frac{3}{4}$ , greater than snout, subequal with interorbital; maxillary reaches  $\frac{1}{2}$  to  $\frac{3}{8}$  in eye, expansion  $1\frac{1}{2}$  to  $1\frac{3}{4}$ , length 2 to  $2\frac{1}{2}$  in head from snout tip; interorbital  $3\frac{1}{8}$  to  $3\frac{1}{2}$ , convex; preopercular spine nearly

equals combined snout and eye in young and its entire upper edge with fine retrorse serrae; spines on head all larger in young. Gill rakers 11 + 22, slenderly lanceolate,  $\frac{2}{3}$  of eye; gill filaments  $\frac{3}{4}$  of gill rakers.

Scales 47 to 52 + 4 or 5 in lateral line; 4 above, 15 below, 20 predorsal forward nearly to snout tip; 6 across cheek to angle of preopercle ridge; 5 rows on maxillary expansion. Scales with 7 or 8 basal radiating striae; 21 or 22 apical denticles; circuli moderate, basal, obsolete apically.

D. X, 15 or 16, fourth spine  $1\frac{3}{4}$  to 2 in total head length, first ray  $2\frac{1}{8}$  to  $2\frac{1}{4}$ ; A. III, 7, second anal spine  $2\frac{1}{8}$  to  $2\frac{1}{4}$ , third ray  $1\frac{3}{8}$  to 2; caudal  $1\frac{1}{8}$  to  $1\frac{1}{4}$ , upper lobe often little longer; least depth of caudal peduncle  $2\frac{3}{8}$  to  $3\frac{1}{8}$ ; pectoral  $1\frac{1}{8}$  to  $1\frac{1}{2}$ , rays 1, 21; ventral rays I, 5, fin  $1\frac{5}{8}$  to  $1\frac{7}{8}$  in total head length.

Largely uniform pale brown, whitish below. Large darker brown diffuse blotch on head above, 4 along dorsal bases on back, with another less distinct on caudal peduncle above. Iris gray. Fins pale or uniformly whitish, membranes of spinous dorsal with dusky to blackish dots, closer and more segregated basally.

A.N.S.P., No. 63916. Washed ashore on Natal coast with plankton, including unusual crustaceans, after heavy weather. July 11, 1932. Length 38 mm. Type. Also Nos. 63917 to 63931, same data, paratypes. Length 21 to 37 mm.

Apparently unique among all the members of its subfamily in the combination of its characters. The apparent absence of teeth from the palate and heavy armature of the head are also salient features.

(*Preopercularis*, with reference to the strong spines of the preopercle.)

***Grammistes sexlineatus*** (Thunberg).

One, 90 mm. Durban beach, 1931.

## PLESIOPSIDAE

***Plesiops nigricans*** (Rüppell).

One, 240 mm. "Intense brown, profusely dotted with white." Off rocks, Natal harbor.

## PEMPHERIDAE

***Pempheris mangula*** Cuvier.

Two, 70 to 115 mm.

## PRIACANTHIDAE

***Priacanthus hamrur*** (Forskål).

Three, 66 to 348 mm. In largest 20 lower gill rakers. Dorsal rays 14, anal 14. Ventral pale or whitish, with dark gray round spots on both membranes and rays of fin.

## LUTJANIDAE

***Lutjanus argentimaculatus*** (Forskål).

One, 194 mm.



**Lutjanus fulviflamma** (Forskål).

One, 140 mm.

**Lutjanus spilurus** (Bennett).

One, 224 mm. Third horizontal blue band not reaching forward beyond hind preopercle edge. Fourth band lowest, extends from below eye to slightly below middle of caudal base. Dark brown blotch, size of eye, between second and third bands, below front of soft dorsal.

**Lutjanus rivulatus** (Cuvier).

One, 217 mm.

**POMADASYIDAE****PLECTORHINCHINAE****Plectorhinchus plagiodesmus**, new species. Figure 20.

Depth  $2\frac{1}{4}$ ; head  $2\frac{3}{8}$ , width  $2\frac{1}{10}$ . Snout  $2\frac{1}{4}$  in head; eye 6,  $2\frac{3}{8}$  in snout,  $1\frac{1}{2}$  in interorbital; maxillary reaches opposite hind nostril, length  $3\frac{3}{8}$  in head; lips broad, thick, fleshy; band of fine, villiform teeth in each jaw, of 4 or 5 series transversely, none on palate or tongue; interorbital  $3\frac{3}{8}$ , broadly convex; hind preopercle edge finely serrated. Gill rakers  $10 + 17$ , lanceolate,  $\frac{1}{2}$  of gill filaments, which  $1\frac{1}{2}$  in eye.

Scales  $48 + 7$  in lateral line; pores  $43 + 6$  in lateral line; 11 rows above, 15 below, 40 predorsal forward opposite hind nostril; 15 obliquely across cheek to preopercle ridge at angle and 12 more on flange to hind edge. Scales on body all disposed in oblique series, especially above lateral line, lowest rows on trunk and tail least inclined. Scales small on predorsal, chest, breast and caudal base. Snout, preorbital, jaws and under surface of head naked. Scales with 9 or 10 basal radiating striae; 69 to 108 slender apical denticles, with 6 to 20 transverse series of basal elements; circuli very fine, basal, obsolete apically. Suprascapular edge denticulate.

D. XIV, 15, 1, membranes of spinous fin deeply incised marginally, third spine  $2\frac{1}{4}$  in head, fifth ray 2; A. III, 7, 1, second spine  $2\frac{3}{8}$ , third ray  $1\frac{1}{2}$ ; caudal  $1\frac{1}{2}$ , as expanded hind edge truncate; least depth of caudal peduncle 3; pectoral  $1\frac{1}{2}$ , rays 1, 14; ventral rays I, 5, fin  $1\frac{1}{2}$  in head.

Dark olive brown, scarcely paler below. Lips and under surface of head light brownish. Iris slate gray. On body 4 conspicuous blackish, oblique bands, all inclined backward below and alternating narrow one parallel in each pale interval; first broad one from first dorsal spine down to little behind pectoral base; second broad one between bases of third and fourth dorsal spines to near end of depressed pectoral; third broad one from base of seventh dorsal spine toward front of spinous anal; fourth broad one from about base of twelfth dorsal spine towards front of caudal peduncle behind anal fin. All fins more or less dark or dusky brown. Dark bar, short, below bases of last dorsal rays.

A.N.S.P., No. 25868. St. Lucie estuary, North Zululand. Length 405 mm. Type. "Slaty blue, with bands of darker mixed with vandyke brown, crossing body obliquely. Narrower bands vandyke brown. Lips chrome yellow. Orange red slit on operculum. Eyes brown, mixed with olive and yellow."

A very interesting species, remarkable for its combination of characters. It falls in the subgenus *Pseudopristipoma* Sauvage as represented by *Plectorhinchus niger* (Cuvier). That species is without the dark oblique bands, and the second anal spine longer than the height of the soft anal fin.

( $\pi\lambda\acute{\alpha}\gamma\iota\omicron\varsigma$  slant +  $\delta\epsilon\iota\sigma\mu\omicron\varsigma$  band; with reference to the dark inclined bands on the body.)

***Plectorhinchus faetela*** (Forskål). Figure 21.

One, 110 mm. Natal. March 22, 1932. An interesting addition to the South African fauna. Known from the adjacent Indian Ocean at Mozambique, Mauritius, and Madagascar; also originally from the Red Sea. My specimen of further interest as different from the published figures and most descriptions in the disposition or arrangement of its dark longitudinal lines.

***Plectorhinchus chubbi*** (Regan). Figure 22.

One, 69 mm. Durban beach, 1931.

***Plectorhinchus pictus*** (Thunberg).

Two, 112 to 133 mm. Durban Bay.

## TERAPONIDAE

***Terapon jarbua*** (Forskål).

One, 212 mm.

## SPARIDAE

***Dentex lineopunctatus*** Boulenger.

One, 473 mm.

***Dentex undulosus*** Regan.

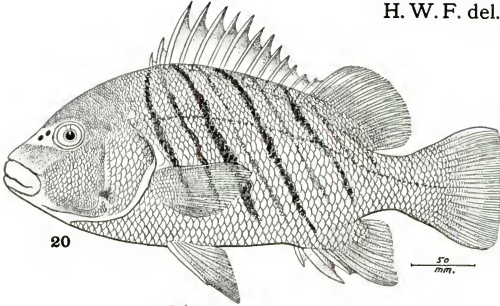
Depth  $2\frac{1}{2}$ ; head  $3\frac{1}{2}$ , width 2. Snout 3 in head; eye  $3\frac{3}{4}$ ,  $1\frac{1}{2}$  in snout, 1 in interorbital; maxillary reaches opposite front eye edge, expansion  $2\frac{1}{4}$  in eye, length 3 in head; front canines 4 above, 7 below; bands of fine teeth in each jaw, outer row uniformly enlarged; interorbital  $3\frac{1}{2}$ , convex; preopercle edge entire. Gill rakers 9 + 15, lanceolate,  $\frac{1}{2}$  of gill filaments, which 2 in eye.

Scales 57 in lateral line to caudal base, and 7 more nontubular on latter; 9 above, 17 below, 55 predorsal forward opposite front nostril; 11 rows of scales across cheek to angle of preopercle ridge and 8 more on preopercular flange. Suprascapula scaly, entire. Scales with 9 or 10 basal radiating striae; 65 to 103 short apical denticles, with 10 to 15 transverse series of basal elements; circuli very fine, obsolete apically.

D. XII, 10, 1, fourth spine  $2\frac{2}{3}$  in head, fourth ray 3; A. III, 9, 1, third spine 3, first ray 3; caudal 1, well forked, lobes pointed; least depth of caudal peduncle 3; ventral  $1\frac{1}{3}$ , rays I, 5; pectoral II, 14, fin 3 in fish without caudal.

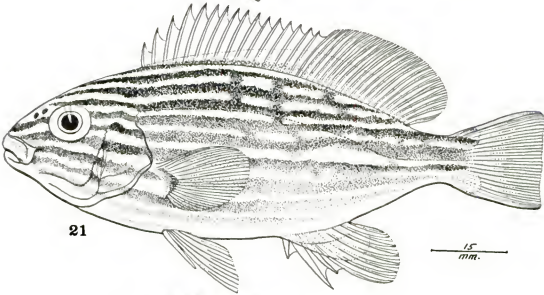
Light brown generally, scarcely paler below. Iris gray. Six rather irregular, waved, longitudinal dark-brown narrow streaks; uppermost along dorsal base; second and third above lateral line; fourth and fifth slope up

H. W. F. del.



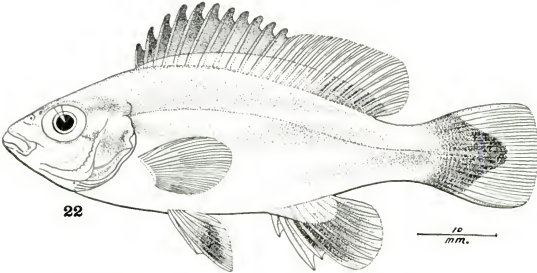
20

50  
mm.



21

15  
mm.



22

10  
mm.

20. *Plectorhinchus plagiodesmus*.      21. *Plectorhinchus faetela*.  
22. *Plectorhinchus chubbi*.

over lateral line posteriorly. On lateral line, from opposite bases of fourth and fifth dorsal spines, narrow blackish transverse blotch, extends from dark longitudinal band immediately above lateral line across 2 lower bands below. Vertical fins grayish and paired fins pale or whitish.

One, 284 mm.

**Dentex filiosus** Valenciennes. Figure 23.

One, 70 mm. From stomach of "Steinbras", Durban. October 1932. Lower gill rakers 15.

**Sparus gibbiceps** Valenciennes.

One, 383 mm. Third dorsal spine equals half of fish without caudal, and fourth but little shorter. Also shows squamous area of the cheek extending forward of the eye, and then down to the hind end of the maxillary, not as in diagram b of Barnard. I also count in a line from the middle of the lower eye edge 15 scales to the angle of the preopercular keel and 8 more across the preopercular flange to its lower hind angle.

**Sparus filamentosus** (Valenciennes). Figure 24.

Depth 2; head  $3\frac{1}{8}$ , width  $1\frac{3}{8}$ . Snout 2 in head; eye  $3\frac{3}{8}$ , longer than deep,  $1\frac{1}{8}$  in snout,  $1\frac{1}{8}$  in interorbital; maxillary reaches opposite front eye edge, length  $2\frac{1}{2}$  in head; 4 conic canines in front of each jaw, and 3 rows of molars posteriorly in each, of which median largest; interorbital  $2\frac{5}{8}$ , broadly convex. Gill rakers  $8 + 9$ , low, tubercles,  $\frac{1}{3}$  of gill filaments, which 2 in eye.

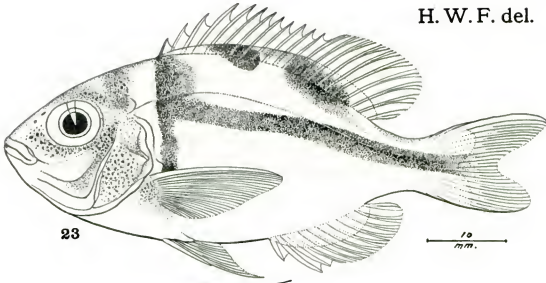
Scales 51 in lateral line to caudal base and 6 more nontubular out over latter; 7 above, 14 below, 35 predorsal forward opposite front nostril; 6 rows of narrowly imbricated scales across lower squamous area of cheek horizontally, this extends forward to hind expansion of maxillary. Scales with 10 to 12 radiating basal striae, and many as 9 incomplete auxiliaries sometimes present; 128 or 129 short, feeble apical denticles, with 3 to 16 transverse series of basal elements; circuli fine, very minute, obsolete apically.

D. XII, 10, 1, first and second spines very short, third elongated or  $2\frac{3}{4}$  in fish without caudal, first ray  $2\frac{1}{2}$ ? in head, membranes of spinous fin deeply incised, especially third following third spine; A. III, 8, 1, second spine 3, first branched ray  $3\frac{1}{4}$ ; caudal  $1\frac{1}{6}$ , emarginate behind; least depth of caudal peduncle  $2\frac{1}{4}$ ; ventral  $1\frac{1}{3}$ , rays I, 5; pectoral II, 13, fin reaches anal or  $2\frac{1}{2}$  in fish without caudal.

In alcohol pale or light brown, with general pinkish cast, especially below. Iris gray. Fins all pale, lower variously tinged with light pink.

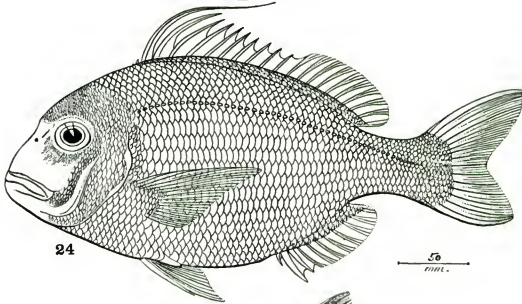
Length 334 mm. Off Cape St. Lucie, north Zululand. January 13, 1935. This rare species has been seen but seldom since it was described in 1830 as *Pagrus filamentosus* by Valenciennes. Although he mentions 17 or 18 longitudinal lines, deeper brown than the general color of each side, I suspect these are likely the result of preservation. Apparently the largest recorded specimen is the type, given by Sauvage as 220 mm. Mr. Marley's notes on the specimen when fresh are: "Bright rosy, shot with

H. W. F. del.



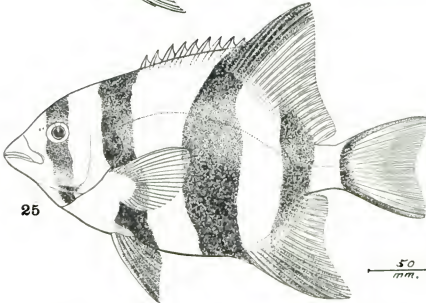
23

10  
mm.



24

50  
mm.



25

50  
mm.

23. *Dentex filusus*.      24. *Sparus filamentosus*.  
25. *Oplegnathus robinsoni*.

opalescence, fading to paler on belly. Top of head and over eye gamboge. Scales below lateral line have a bright small blue spot. Dorsal membrane gamboge, except at base, spines deep gamboge. Caudal dark rose. Pectoral and ventral pale pink, with a little opalescence. Eye with cloudings of pale rose. Upper lip yellow, lower paler. Taken on hook and line."

**Diplodus trifasciatus** (Rafinesque).

Length 299 mm.

### CENTRACANTHIDAE

**Centracanthus australis** (Regan).

Depth  $3\frac{1}{4}$ ; head 3, width 2. Snout 3 in head from snout tip; eye  $3\frac{1}{2}$ ,  $1\frac{1}{2}$  in snout, subequal with interorbital; maxillary reaches front eye edge, expansion 2 in eye, length  $2\frac{1}{4}$  in head from snout tip; teeth in narrow villiform band above, 4 or 5 irregular transverse rows; below small simple conic teeth, biserial anteriorly in jaws, uniserial posteriorly; palate edentulous; interorbital  $3\frac{3}{4}$ , low, broadly convex. Gill rakers  $7 + 19$ , lanceolate, finely spinescent,  $1\frac{1}{2}$  in gill filaments, which  $2\frac{1}{2}$  in eye.

Scales 52 in lateral line to caudal base and 7 more on latter; 7 above, 14 below, 30 predorsal forward opposite middle of interorbital; 5 rows across cheek to angle of preopercle ridge and 8 more across preopercle flange to its lower hind edge. Lateral line little high along back, especially posteriorly and along side of caudal peduncle, sloping down posteriorly to middle of caudal base. Scales with 9 basal radiating striae; 59 to 105 short feeble apical denticles, with 10 to 15 transverse series of basal elements; circuli fine, basal, obsolete apically.

D. XII, 10, 1, fourth spine  $2\frac{9}{10}$  in total head length, first ray  $3\frac{1}{2}$ ; A. III, 8, 1, third spine  $3\frac{1}{2}$ , first ray  $3\frac{1}{2}$ ; caudal  $1\frac{3}{4}$ , forked, lobes sharp pointed; least depth of caudal peduncle  $4\frac{1}{2}$ ; pectoral  $1\frac{1}{10}$ , rays II, 13; ventral I, 5, fin 2 in total head.

Pale brownish, scarcely lighter below. Iris gray. Fins all light.

One, 311 mm.

### OPLEGNATHIDAE

**Oplegnathus robinsoni** Regan. Figure 25.

Depth  $1\frac{1}{2}$ ; head  $2\frac{1}{2}$ , width  $1\frac{1}{4}$ . Snout  $2\frac{3}{4}$  in head; eye 5, 2 in snout,  $1\frac{1}{2}$  in interorbital; maxillary reaches below hind nostril or  $\frac{2}{3}$  in snout, length 3 in head; mouth cleft nearly horizontal; interorbital 3, broadly convex; preopercle edge with small, uneven denticles. Gill rakers  $8 + 17$ , lanceolate,  $1\frac{1}{4}$  in gill filaments, which  $1\frac{1}{4}$  in eye.

Scales 107 along lateral line to caudal base; about 72 tubular scales in lateral line to caudal base; 28 scales above lateral line, 60 below; 30 predorsal scales forward to occiput and 18 more still forward till opposite front eye edge; 23 obliquely across cheek to hind angle of preopercle edge, of which 4 or 5 on preopercle flange. Scales with 3 to 11 basal radiating striae and 0 to 3 incomplete auxiliaries; 20 to 32 short apical denticles, with 3 to 6 transverse series of basal elements; circuli rather coarse, basal.

D. IX, 21, 1, last spine  $3\frac{2}{3}$  in head, third ray  $1\frac{1}{2}$ ; A. III, 16, 1, third spine  $3\frac{1}{2}$ , second ray  $1\frac{1}{2}$ ; caudal (damaged) 1?, apparently emarginate; least depth

of caudal peduncle  $2\frac{1}{3}$ ; pectoral  $1\frac{1}{3}$ , rays 11, 19; ventral rays I, 5, fin  $1\frac{1}{4}$  in head.

Rather light brown generally. Five blackish brown transverse bands; first wide as eye, from interorbital space through eye to isthmus; second broader, from predorsal to pectoral and ventral bases; third widest, from last dorsal spines and front of soft dorsal to front of anal; fourth from last dorsal to last anal rays; fifth at caudal base. Soft dorsal and caudal blackish terminally, spinous dorsal pale or light brown. Caudal brown, edged blackish above, below and behind. Pectoral gray olive. Ventral blackish.

One, 294 mm. This species was known hitherto only from the type, 150 mm. long. "Banded with brown, back marked with yellow. Eye yellow, with brown over top."

### MULLIDAE

*Pseudupeneus barberinus* (Lacépède).

One, 172 mm.

*Pseudupeneus fraterculus* (Valenciennes).

Three, 15 to 380 mm. Smallest washed ashore with plankton, after a heavy storm on Natal coast, July 11, 1932.

### SCIAENIDAE

*Otolithes ruber* (Schneider).

Two, 238 to 240 mm.

*Johnius belengerii* (Cuvier).

One, 189 mm.

*Sciaena striata* Boulenger.

One, 77 mm. Durban beach, 1931.

*Sciaena robinsoni* (Gilchrist and Thompson).

One, 263 mm.

*Sciaena fuscolineata* (Von Bonde).

One, 197 mm. Scales  $48 + 8$  in lateral line. Depth  $3\frac{3}{8}$ ; head  $3\frac{1}{8}$ . D. X, I, 25, 1. Known chiefly by its cycloid scales.

### HISTIOPTERIDAE

*Quinquarius capensis* (Cuvier). Figure 26.

Depth 2; head  $2\frac{1}{2}$ , width 2. Snout  $2\frac{1}{2}$  in head from snout tip; eye 3,  $1\frac{1}{8}$  in snout, greater than interorbital; maxillary reaches  $\frac{2}{3}$  to eye, length  $3\frac{3}{4}$  in head; teeth small, simple, conic, in bands in jaws, in 4 or 5 irregular series transversely anteriorly and narrowing posteriorly in jaws; patch of low, broad, blunt teeth on vomer, none on palatines or tongue; interorbital  $3\frac{3}{8}$ , low, slightly concave medianly; all bones of head with surfaces finely rugose striate. Gill rakers  $5 + 17$ , lanceolate, equal gill filaments or  $\frac{1}{4}$  of eye.

Scales  $45 + 2$  in lateral line; 7 above, 20 below, 14 predorsal, 4 rows on cheek below eye. Scales with 38 to 60 short apical denticles, with 4 to 6 transverse series of basal elements; circuli very fine, basal, obsolete apically.

D. XII, 12, 1, third spine  $1\frac{1}{4}$  in total head length, third ray  $2\frac{1}{6}$ ; A. IV, 8, 1, second spine 2, third ray  $2\frac{1}{2}$ ; caudal  $1\frac{2}{3}$ , slightly emarginate behind; least depth of caudal peduncle 3; pectoral 1, rays 11, 14; ventral rays I, 5, fin  $1\frac{1}{4}$  in total head length.

Brown, exposure of each scale paler. Chest, breast and belly little lighter than back. Iris gray. Fins all brownish, ventrals blackish terminally. Dorsal, anal and ventral spines horn color.

One, 180 mm. Besides the type, which apparently lost, only one other specimen known and that obtained by the ship "Pickle" off Natal. As Gilchrist has given no details the present specimen, apparently greatly larger than any heretofore seen, is especially interesting.

### PLATACIDAE

*Platax pinnatus* (Linnaeus).

One, 133 mm.

*Platax orbicularis* (Forskål).

One, 112 mm.

### MONODACTYLIDAE

*Monodactylus falciformis* Lacépède.

One, 160 mm.

### CHAETODONTIDAE

*Chaetodon setifer* Bloch.

One, 150 mm.

*Chaetodon blackburnii* Desjardins. Figure 27.

Depth  $1\frac{3}{4}$ ; head  $3\frac{2}{3}$ , width 2. Snout  $3\frac{1}{2}$  in head; eye  $3\frac{2}{3}$ ,  $1\frac{1}{3}$  in snout,  $1\frac{1}{3}$  in interorbital; maxillary reaches  $\frac{2}{3}$  to eye, length  $4\frac{1}{4}$  in head; interorbital  $3\frac{2}{3}$ , broadly convex; preopercle edge minutely serrate. Gill rakers  $6 + 11$ , short points,  $\frac{1}{3}$  of gill filaments, which  $1\frac{2}{3}$  in eye.

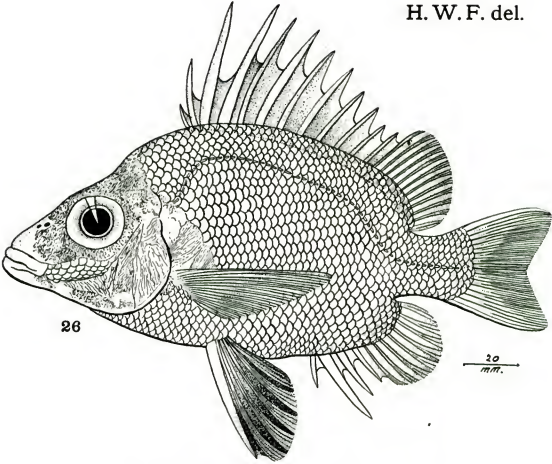
Pores 34 in lateral line until below last dorsal rays; scales 44 in median lateral series between gill opening and caudal base; 9 above lateral line, 24 below, 32 irregular predorsal, 9 rows obliquely across cheek to lower hind angle of preopercle edge of which 3 on preopercular flange. Vertical fins all more or less scaly, soft ones scaly nearly or quite to edges. Scales with 8 to 13 basal radiating striae; 78 to 83 short apical denticles, with 3 to 9 transverse series of basal elements; circuli very fine, basal, few or obsolete apically.

D. XVI, 23, 1, fourth spine  $2\frac{2}{3}$  in head, seventh ray  $1\frac{1}{2}$ ; A. III, 18, 1, third spine  $1\frac{1}{2}$ , fifth ray  $1\frac{1}{4}$ ; caudal  $1\frac{1}{3}$ , truncate as expanded; least depth of caudal peduncle  $3\frac{1}{4}$ ; pectoral  $1\frac{2}{3}$ , rays 11, 14; ventral rays I, 5, fin  $1\frac{1}{3}$  in head.

Brown, becoming very dark or blackish brown on back and posteriorly on body. Blackish band from predorsal through eye down to tip of front of

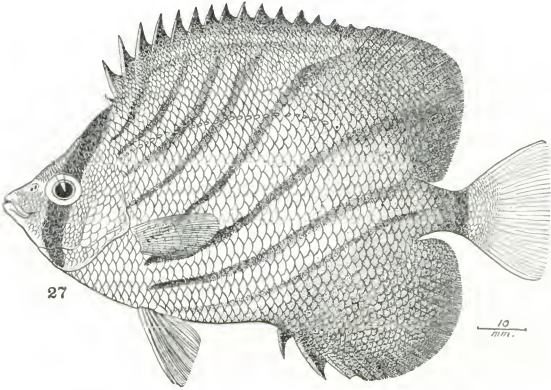


H. W. F. del.



26

20  
mm.



27

10  
mm.

26. *Quinquarius capensis*.

27. *Chaetodon blackburnii*.

breast, narrowed below. Body with 8 inclined, dark gray, parallel lines or narrow bands, all starting from behind head, most narrow at first and broader behind, all finally lost in black color of soft dorsal and anal and caudal peduncle. Head posterior to black ocular band quite pale brown. Dorsals dark or blackish, broadly marginally and basally, so whole extent of spinous dorsal with median light brown band which finally obliterated in front upper blackish soft fin. Iris gray black. Caudal pale or light brown, nearly whitish on broad hind margin. Pectoral brown. Ventral pale olive, dusky or dark brownish anteriorly and terminally.

One, 108 mm. Bluff, Durban, Natal. June 25, 1934. "Dark uniform olive brown, with faint cross-lines of same color. Black band running over head, through eye, to lower gill flaps. White over nostrils. Some yellow in pectoral fin area and through dorsal spines. Soft dorsal and anal fins very dark. Caudal light olive, fringed with mauve."

A very interesting little-known species, and new to the South African fauna. Apparently it has not been found or reported since described from Mauritius, in 1836, and the crude figure by Valenciennes several years later, doubtless from the type.

***Chaetodon cingulatus* Fowler.**

One, 120 mm. Differs a little from the type in showing a very obsolete or indistinct slightly darker brownish area above pectoral and another below last six dorsal spines on the back, these hardly as broad as transverse bands. Also at base of each scale below lateral line a very indistinct, small, ill-defined dark spot.

***Heniochus acuminatus* (Linnaeus).**

One, 213 mm.

***Pomacanthus striatus* (Rüppell).**

Two, 186 to 221 mm.

***Pomacanthus semicirculatus* (Valenciennes).**

Length 311 mm. Differs from the preceding in the caudal rounded and hind edge narrowly white. Soft dorsal and anal with extended points. Side of body with black spots of uniform dark brown color. Preopercular spine nearly twice eye.

**SIGANIDAE**

***Siganus rivulatus* (Forskål).**

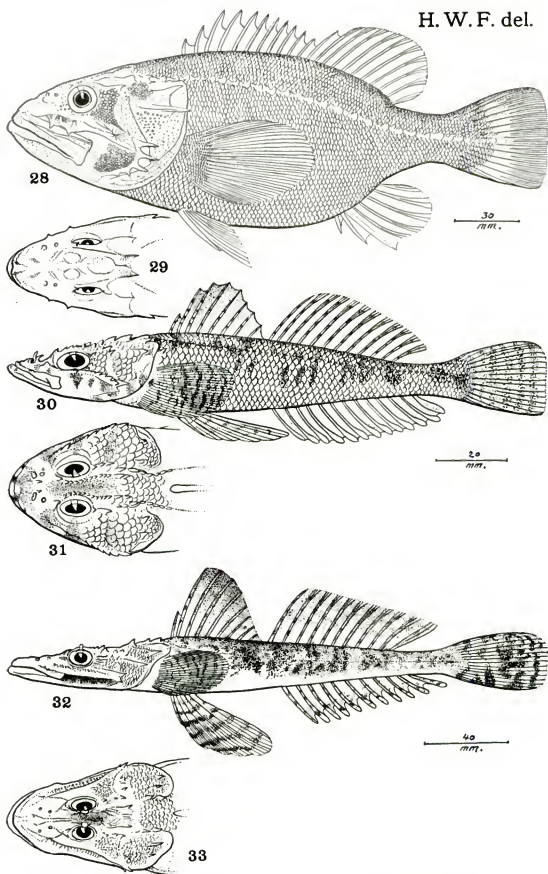
One, 189 mm.

**CIRRHITIDAE**

***Cirrhitus pinnulatus* (Schneider).**

One, 140 mm.

H. W. F. del.



28, 29. *Setarches marleyi*.      30, 31. *Grammophites pristis*.  
 32, 33. *Platycephalus papilloculus*.

## SCORPAENIDAE

*Scorpaenopsis cirrosa* (Thunberg).

Three, 140 to 194 mm.

*Setarches marleyi*, new species. Figures 28 and 29 (dorsal view of head).

Depth  $2\frac{2}{3}$ ; head  $2\frac{1}{2}$ , width 2. Snout  $2\frac{1}{8}$  in head from snout tip; eye 6, 2 in snout,  $1\frac{1}{2}$  in interorbital; maxillary reaches  $\frac{3}{8}$  in eye, expansion  $1\frac{1}{8}$  in eye, length 2 in head from snout tip; teeth in villiform bands in jaws, on vomer and palatines; interorbital  $4\frac{1}{4}$ , low, slightly convex. Small antero-supraorbital spine, directed back; 2 inferior preorbital spines over middle of maxillary; very low, small spine on suborbital stay; 3 spines at angle of preopercle edge, parallel, median slightly largest and directed back, also 2 small, inconspicuous ones on lower edge of preopercle; 2 rather strong, divergent spines on opercle; pair of small parietal spines, directed back and laid close to predorsal region. Gill rakers  $7 + 14$  (only  $4 + 10$  perfected, others rudimentary), lanceolate, twice gill filaments or 2 in eye.

Scales 70 counted along close above lateral line to caudal base and 6 more on latter; tubes  $22 + 6$  in lateral line, large, membranous-like capsules; 12 above, 27 below, 15 predorsal; 7 postorbital rows, 11 rows below suborbital stay. Scales with 4 or 5 basal radiating striae; circuli very fine, present though less developed apically.

D. XI, I, 10, 1, fourth spine  $3\frac{2}{5}$  in total head length, second ray  $2\frac{2}{3}$ ; A. III, 5, 1, third spine 3, second ray  $2\frac{1}{4}$ ; caudal 2, truncate behind, slightly convex as expanded; least depth of caudal peduncle 4; pectoral  $1\frac{1}{3}$ , rays I, 21; ventral rays I, 5, fin 2 in total head length.

General color drab to lavender or heliotrope purple, under surface of belly dark gray. Iris gray. Fins and naked bony areas of head all light or pale colored.

A.N.S.P., No. 63797. Off Natal, South Africa. Length 244 mm. Type.

Differs from *Setarches guntheri* Johnson in the lower spinous dorsal, shorter maxillary and different shape of the occipital fontanel.

(For Mr. H. W. Bell-Marley.)

*Pterois volitans* (Linnaeus).

Four, 154 to 275 mm.

## PLATYCEPHALIDAE

*Grammoplites pristis* (Peters). Figures 30 and 31 (head viewed above).

Depth  $5\frac{2}{3}$ ; head  $2\frac{1}{2}$ , width  $1\frac{1}{4}$ . Snout  $3\frac{1}{8}$  in head from snout tip; eye  $4\frac{1}{2}$ ,  $1\frac{1}{2}$  in snout, much greater than width of narrow interorbital; maxillary reaches  $\frac{1}{4}$  in eye, expansion 3 in eye, length  $2\frac{3}{4}$  in head from snout tip; bands of finely villiform teeth in jaws, on vomer and palatines; interorbital concave. Pair of well-developed nasal spines; supraorbital ridge denticulate, each ridge preceded by slightly larger denticle or spine; single, small, forward directed preorbital spine each side; suborbital stay serrated (with front left edge smooth); 2 opercular spines, upper little larger; 2 preopercular spines, lower much shorter and directed back like upper, which is furnished with a small outer auxiliary basal one; postorbital and parietal

spinescent ridges distinct and conspicuous. Gill rakers  $1 + 4$ , also 4 more rudimentary, low, flattened, asperous tubercles above and below; short,  $1\frac{2}{3}$  in gill filaments, which 3 in eye.

Scales  $50 + 3$  in lateral line, only first 7 or 8 furnished with median, backward, directed spine; 4 above, 12 below, 8 predorsal forward to occiput. Cheek below suborbital stay papillate. Scales with 4 basal radiating striae and 2 to 5 incomplete auxiliaries; 40 to 56 short, uniform apical denticles, with 2 to 5 transverse series of basal elements; circuli very fine.

D. VIII — 12, 1, fourth spine  $2\frac{2}{3}$  in total head length, third ray  $2\frac{2}{3}$ ; A. 13, 1, third ray 3; caudal  $1\frac{3}{4}$ , convex behind; least depth of caudal peduncle 4; pectoral  $1\frac{1}{2}$ , rays 11, 18; ventral 1, 5,  $1\frac{1}{2}$  in head.

Brown, with obscure transverse bands on back; first obscurely at occiput; second narrow, at front of spinous dorsal or slightly before; third broad, at greater posterior part of spinous dorsal; broad fourth band at last dorsal rays; fifth at caudal peduncle. Dark blotch on cheek below suborbital stay. Whole back, in both dark and pale areas, obscurely mottled. Under surfaces of head and body whitish. Iris gray. Fins pale or transparent; outer portions of spinous dorsal blackish gray; dorsal fin rays each with 5 or 6 dark gray blotches; caudal with blackish basal transverse band and 5 or 6 dark gray blotches on each ray, much broader than pale interspaces; pectoral with 5 or 6 transverse series of dark gray spots on each ray; ventral and anal uniformly pale.

One, 158 mm. An interesting addition to the fauna of Natal. *Wakiyus* Jordan and Hubbs 1925 agrees in having only the anterior scales of the lateral line each with a spine, but differs in "a cirrose lappet on cornea above pupil" and the much rougher armature of the head.

***Platycephalus papilloculus***, new species. Figures 32 and 33 (head viewed above).

Depth  $8\frac{1}{2}$ ; head  $2\frac{3}{4}$ , width  $1\frac{1}{2}$ . Snout  $2\frac{1}{2}$  in head from snout tip; eye  $6\frac{1}{2}$ ,  $2\frac{1}{8}$  in snout, little over twice width of interorbital; maxillary reaches nearly opposite front eye edge, expansion 2 in eye, length 3 in head from snout tip; teeth villiform, in broad bands in jaws, about 15 irregular transverse series above anteriorly, narrowing posteriorly; lower jaw bands of teeth much narrower, 5 or 6 irregular series transversely; narrow band of villiform teeth on each palatine and horseshoe-shaped arch on vomer; interorbital deeply concave. No nasal spines; strong antero-supraorbital spine, followed by strong entire keel, with strong postocular spine; no preorbital spine; suborbital stay with spine below eye; preopercle with 3 spines, lowest smallest and uppermost largest, this slightly directed upward; 2 opercular, upper more posterior; large lower postocular spine, followed by 3 spines to suprascapula; upper postocular with 3 or 4 approximating keels behind and then pair of large spines at occiput. Gill rakers  $2 + 4$ , equal gill filaments or  $2\frac{1}{2}$  in eye.

Scales  $88 + 9$  in lateral line; tubes  $50 + 2$ , bifid; 9 above, 22 below, 14 predorsal forward to occiput. Arborescent venules on snout, interorbital, postorbital, opercle, and along lower edge of suborbital stay. Scales with 11 to 13 basal radiating striae; 23 to 28 slender apical denticles, with 5 or 6 transverse series of basal elements; circuli fine.

D. IX — 11, 1, second spine  $2\frac{3}{4}$  in total head length, second ray  $2\frac{3}{4}$ ; A. 11, 1, second ray  $3\frac{3}{4}$ , fin edge deeply notched; caudal  $1\frac{3}{4}$ , convex behind; least depth of caudal peduncle 7; pectoral  $2\frac{2}{7}$ , rays II, 18; ventral rays I, 5, fin length  $1\frac{3}{8}$  in total head length.

Back and upper surfaces olive brown with obscured darker to blackish mottlings or blotches. Under surfaces whitish. Over entire upper surface are scattered very small blackish dots, scarcely discernible without a lens. Broad blackish-brown bar along and parallel close below suborbital stay. Black blotch obscured, at front of opercle. Spinous dorsal whitish, with large gray-black blotch terminally. Soft dorsal pale or whitish, each ray with 3 or 4 grayish blotches. Caudal pale brownish, with 4 irregular gray transverse bars, broken into variable spots above and terminally, and as 4 black blotches along lower edge of fin. Pectoral grayish, mottled with gray and black. Ventral whitish, mottled gray and with several large black blotches terminally. Anal whitish, with small black and gray spots terminally.

A.N.S.P., No. 63808. Durban, Natal. Length 258 mm. Type.

Agrees largely with *Platycephalus maculipinna* Regan 1905 from Muscat, Arabia, but that species of different coloration, or less variegated, and lacks the supraorbital papilla, so conspicuous in mine.

(*Papilla* lappet + *oculus* eye.)

#### CEPHALACANTHIDAE

*Dactyloptena orientalis* (Cuvier).

One, 118 mm. Day's figure of *Dactylopterus orientalis* as reproduced by Barnard, shows the dorsal with but one long free spine anterior to the dorsal, the soft dorsal doubtless concealed by the unnatural vertically expanded, pectoral. "Whole surface marked with various shades of rosy yellow and blue gray."

#### CICHLIDAE

*Tilapia natalensis* (Weber).

One, 120 mm., "Kenyo Gly "; three, 55 to 99 mm., Uvongo River.

*Tilapia kafuensis* Boulenger.

One, 205 mm., Umgeni River; also one, 274 mm. The smaller specimen differs only in its light coloration, while all have 4 rows of scales on the cheek, of which the lowest row variably of but 2 or 3 scales.

*Tilapia sparrmani* Andrew Smith.

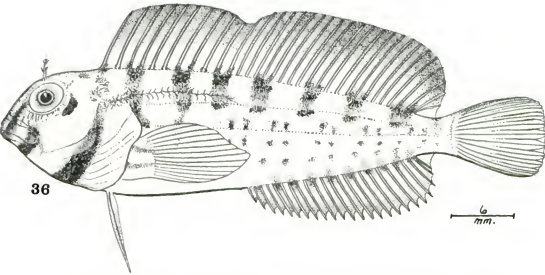
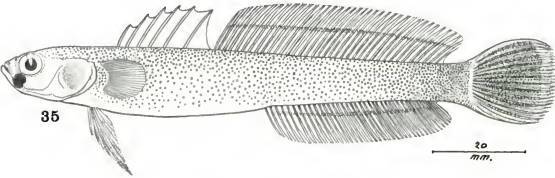
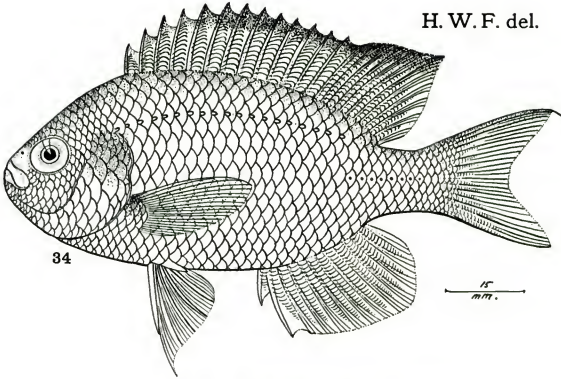
Two, 47 to 110 mm., Uvongo River, 1933.

#### POMACENTRIDAE

*Abudefduf dasygenys*, new species. Figure 34.

Depth  $2\frac{1}{4}$ ; head  $3\frac{1}{4}$ , width  $1\frac{1}{2}$ . Snout  $4\frac{2}{3}$  in head; eye  $3\frac{1}{2}$ , greater than snout, equals interorbital; maxillary reaches eye, expansion 3 in eye; about 38 above, 36 below, compressed, truncate teeth in each jaw, uniserial,

H. W. F. del.



34. *Abudejduf dasygenys*.      35. *Laccoeleotris lineopinnis*.  
36. *Blennius trifascigula*.

posterior scarcely shorter or smaller than anterior; interorbital low, broadly convex; preopercle edge unevenly rough, hardly distinctly serrate; preorbital depth  $2\frac{1}{2}$  in eye. Gill rakers  $8 + 19$ , lanceolate, equal gill filaments or  $1\frac{1}{2}$  in eye.

Scales 19 in upper tubular section of lateral line, 8 or 9 pores in straight, lower posterior section to caudal base, sometimes pore on latter; 4 above, 12 below, 22 predorsal forward nearly to front of snout end; 4 rows on cheek, with lowest on preopercle flange; preorbital scaly. Scales with 10 basal radiating striae; 147 to 160 small, slender, apical denticles, with 2 or 3 transverse series of basal elements; circuli very fine.

D. XIII, 12, sixth spine  $1\frac{3}{4}$  in head, fourth ray  $1\frac{1}{4}$ ; A. II, 11, second spine  $1\frac{1}{2}$ , sixth ray  $1\frac{1}{2}$ ; caudal 1, upper lobe ends in short filament, emarginate behind; least depth of caudal peduncle  $2\frac{1}{4}$ ; pectoral  $1\frac{1}{10}$ , rays II, 17; ventral rays I, 5, length  $1\frac{1}{2}$  in head.

Largely dull uniform brown, under surface of head, chest, breast and belly scarcely paler. Iris gray. On body scales each with more or less slightly darker basal blotch, not forming much of contrasted pattern. Fins all dull brownish, dorsals and anals little darker terminally, and caudal above and below similar. Paired fins pale, obscure, small, brown spot at pectoral origin.

A.N.S.P., No. 63934. Durban, Natal. Length 110 mm. Type.

Apparently most closely related to the imperfectly described *Glyphisodon sculptus* Peters 1855 and *G. fallax* Peters 1855, both from Mozambique. These two nominal forms differ in structural characters and coloration, as far as may be gathered from their meager descriptions. Though perhaps approaching *G. fallax* in depth, dorsal and anal rays, that species differs in having but 2 rows of scales on the cheek and middle rays of dorsal, anal and caudal lobes extended into filaments.

( $\delta\sigma\upsilon\varsigma$  rough +  $\gamma\acute{\epsilon}\nu\epsilon\iota\omicron\nu$  cheek; with reference to the uneven edge of the preopercle.)

## LABRIDAE

*Lepidaplois trilineatus* Fowler.

One, 228 mm.

*Gomphosus caeruleus* Lacépède.

Depth 3; head  $2\frac{1}{4}$ , width  $2\frac{3}{4}$ . Snout 2 in head; eye 10, 5 in snout; maxillary reaches  $2\frac{1}{2}$  in snout, length  $4\frac{1}{4}$  in head; interorbital  $5\frac{1}{2}$ , convex. Gill rakers  $6 + 19$ , short points,  $5\frac{2}{3}$  in gill filaments, which 4 in snout.

Scales 18,  $7 + 2$ , in lateral line, 4 above, 10 below, 8 predorsal. Small scales on caudal base, along basal portions of spinous dorsal and front of anal. Tubes of lateral line with 3 to 5 branches. Scales with 33 to 51 basal radiating striae; 47 to 60 apical radiating striae; circuli basal, very fine, obsolete apically.

D. VIII, 13, 1, eighth spine  $5\frac{1}{2}$  in head, first ray  $3\frac{3}{4}$ ; A. II, 11, 1, fifth ray 4; caudal  $1\frac{1}{2}$ , hind edge little convex, upper and lower corners with little exserted points; least depth of caudal peduncle 3; pectoral  $2\frac{1}{2}$ , rays II, 13; ventral rays I, 5, fin  $2\frac{3}{4}$  in head.



General color of head and body dark slate green. Iris gray. Dorsal and anal whitish, about basal third black with submargin pale green; on spinous dorsal narrow margin only whitish. Caudal largely whitish, basally and upper and lower edges narrowly slate black. Pectoral blackish basally, then largely dark green, with broad black subborder and narrow edge whitish. Ventral whitish, front edge narrowly blackish terminally.

One 255 mm. *Acarauna longirostris* Sevestianoff 1802, described as "trouvé dans une collection d'animaux de Brésil" was surely from somewhere in the Indo-Pacific. It is synchronous with *Gomphosus caeruleus* Lacépède 1802, accepted here on account of usage.

***Gomphosus varius* Lacépède.**

One, 160 mm. June 28, 1934. "Olive green, darker on back. Below cheek paler, and several dark marks behind eye. Blue dots on lower throat and belly. Eye olive. Dorsal dark olive, edged with brownish pink. Lower fins light olive green, with pale band of maroon at bases of rays, edges of rays darker. Other fins olive."

***Thalassoma purpureum* (Forskål).**

One, 326 mm.

## ELEOTRIDAE

### LACCOELEOTRIS, new genus

Body elongate, compressed, slender, coelome but little less than tail measured to caudal base. Head small, compressed. Snout short. Eye large, before middle in length of head. Maxillary oblique, reaches to eye. Interorbital depressed, narrow. Gill openings wider, gill membranes joined with rather narrow isthmus. Branchiostegals 4. Gill rakers short. Pseudobranchiae not evident. Scales very small, cycloid, well separated, appear as if sunk in the skin and not present on the head. No lateral line. Vertical fins lower than body depth. Soft dorsal begins little before anal. Caudal rounded. Pectoral broad, short. Ventrals separated, inserted opposite pectoral origin.

Type *Laccoeleotris lincopinnis*, new species.

Related to *Ptereleotris* Gill 1863, which has fewer dorsal rays 24 to 36, and fewer anal rays 24 to 32, scales more numerous or 150 to 170 in a longitudinal series, scales forward on predorsal nearly to occiput, and caudal lunate.

(Λάκκος pit + *Eleotris*; with reference to the scales appearing like little pits in the skin.)

***Laccoeleotris lincopinnis*, new species. Figure 35.**

Depth  $6\frac{1}{2}$ ; head 5, width 3. Snout  $5\frac{1}{2}$  in head from snout tip; eye 4, greatly exceeds snout or interorbital; maxillary extends below front eye edge, length 3 in head from snout tip; teeth biserial in jaws, outer series with larger or canine-like ones at intervals; no teeth on palate; tongue long,

slender, pointed, free; interorbital  $5\frac{1}{2}$ , low, depressed or slightly concave. Gill rakers  $5 + 15$ , slender, lanceolate, equal gill filaments, which 2 in eye.

Squamous pits about 108 in axial lateral series to caudal base; 20 transversely above anal origin. Pits indistinct or appear as if more or less obliterated on predorsal and about base of spinous dorsal fin. Pits all crowded posteriorly on body so that on caudal basally quite close or segregated.

D. VI—38, spines flexible, with fifth 2 in total head length, tenth ray  $1\frac{1}{2}$ ; A. I, 36, flexible spine 4; caudal  $1\frac{1}{10}$ , slightly emarginate, though ends of each ray extended in short filament; least depth of caudal peduncle  $2\frac{1}{2}$ ; pectoral 2; ventral  $1\frac{1}{10}$ , spine flexible, 3 in fin; pectoral rays 23; ventral I, 5.

Brown, belly and under surface of head pale drab. Iris gray. Rather broad black band from lower eye edge across under surface of head. Fins all more or less very pale transparent brown, and both second dorsal and anal with median, longitudinal, dull brown, line or very narrow band its entire length. Opercle and middle of caudal with some darker brown than body color, on latter as several obsolete blotches.

A.N.S.P., No. 63932. From the stomach of a flat fish (*Arnoglossus* sp.) taken off Umzumbi in 50 fathoms. June 4, 1934. Length 115 mm. Type.

"Colour of body mauve with shades of pale green. Pinkish mauve in area of upper opercle and along back. Snout yellow. Large brown spots on cheeks. Violet spot below eye, which is banded with shades of bright yellow and emerald green. Top and bottom of eye cobalt. Dorsal banded longitudinally with pale blue, tips of rays yellow. Caudal deep yellow at base and lower rays shaded pale mauve. Pectorals brownish. Ventral violet, tips of rays lemon yellow."

Characters expressed in the genus will differentiate it from species of *Ptereleotris* Gill.

(Linea line + pinna fin; with reference to the dark longitudinal line on both second dorsal and anal.)

### GOBIIDAE

*Glossogobius giuris* (Buchanan-Hamilton).

One, 56 mm., Uvongo River, Natal.

### BLENNIIDAE

*Cirripectes kosiensis* (Regan).

Two, 180 mm.

*Blennius trifascigula*, new species. Figure 36.

Depth  $3\frac{2}{3}$ ; head  $3\frac{1}{3}$ , width  $1\frac{1}{2}$ . Snout 4 in head; eye 4, equals snout, greatly exceeds interorbital; supraorbital flap  $\frac{2}{3}$  of eye, with few short filaments; mouth width  $2\frac{1}{3}$  in head; mouth cleft reaches  $\frac{1}{3}$  in eye; lower canine each side; row of firmly implanted, slender, parallel, close-set teeth in each jaw; interorbital width  $3\frac{1}{4}$  in eye, nearly level. Gill membranes broadly united, form broad, free fold across isthmus. Gill rakers about 10 short papilla like points,  $\frac{1}{3}$  of gill filaments, which  $1\frac{1}{3}$  in eye.

Skin smooth, naked. Lateral line with 22 close-set tubes, each with short branch above and another below, extends back far as tip of depressed pectoral.

D. X, 22, fifth spine  $1\frac{1}{2}$  in head, tenth ray 2; A. II, 21, twentieth ray 3; caudal  $1\frac{1}{2}$ , convex behind; least depth of caudal peduncle 4; pectoral  $1\frac{1}{2}$ , rays 14; ventral  $1\frac{1}{2}$  in head, rays 2.

Brown, but slightly paler on under surface of head and belly. Eight darker brown saddles along back, little reflection on bases of dorsals. Row of dark axial spots along side of body, usually as pair of spots opposite each dark blotch on upper part of back, and irregular obscure scattered spots below. Obscure small dark postocular spot. Dark bar from lower front eye edge across front of mandible. Two other parallel, less distinct, gray bands posteriorly, broader with second or last across gill membranes. Fins pale transparent brownish, clouded obscurely with darker on dorsals and outer edges of anal dark gray. Iris gray.

A.N.S.P., No. 63933. Durban, Natal. Length 56 mm. Type.

Apparently different from *Blennius fascigula* Barnard 1927, especially the coloration, as that species described with 5 dark transverse bars extending on the dorsals and anals, head and pectoral dotted, 3 transverse dark angular bands across the throat and one across chin, also a dark cross bar on caudal. In *B. trifascigula* there are 8 dark blotches on the back, 2 broad dark bands across the throat and one across the chin darker, and caudal uniformly paler. It further differs in the presence of a pair of lower canines, smaller eye, and longer supraorbital tentacle.

(*Tres* three + *fascia* band + *gula* throat.)

#### URANOSCOPIDAE

##### *Uranoscopus archionema* Regan.

Depth  $4\frac{1}{4}$ ; head  $2\frac{3}{4}$ , width  $1\frac{1}{8}$ . Snout in profile  $6\frac{3}{8}$  in head from snout tip; eye  $6\frac{3}{8}$ , subequal with snout in profile,  $1\frac{1}{2}$  in interorbital; maxillary vertical, reaches front eye edge, expansion equals eye, length  $2\frac{1}{4}$  in head from snout tip; each lip with fringe; teeth small, simple, conic, in jaws in bands of 3 or 4 irregular rows; patch of short teeth on vomer and single row on each palatine; interorbital  $4\frac{3}{4}$  in head from snout tip, level; bones of head all rugose striate. Gill rakers as row of very small denticles along edge of gill arch; gill filaments long as eye.

Scales in 53 well-inclined series from suprascapula to caudal base; about 47 scales transversely in oblique row. Scales all firmly adherent, scattered and irregular on predorsal, little smaller on caudal base. Suprascapular spine  $1\frac{1}{2}$  times eye.

D. IV — 13, spines and rays flexible, second spine  $5\frac{1}{4}$  in total head, fourth ray  $2\frac{3}{4}$ ; A. 13, fin edge notched, fourth ray 4; caudal  $1\frac{1}{8}$ , hind edge convex; least depth of caudal peduncle  $3\frac{3}{4}$ ; pectoral  $1\frac{1}{2}$ , rays 18; ventral I, 5, fin 2 in total head.

Brown, paler or little lighter on under surfaces. Back and upper surfaces obscurely clouded with darker. Iris gray. Fins brownish, mostly with paler margins. First dorsal slate black.

One, 323 mm.

## PARAPERCIDAE

*Parapercis nebulosa* (Quoy and Gaimard).

Two, 163 to 273 mm.

## BALISTIDAE

*Balistes chrysopterus* Schneider.

Two, 128 to 205 mm. Usually known by the wrongly applied name *Balistes niger* Park 1791, which is precluded by the same name of Bloch in 1786. "Black, with pale olive in fins. Caudal white, sides fringed white". Umkomaas. August 1933.

*Balistes ringens* Linnaeus.

One, 225 mm.

*Balistes stellatus* Lacépède.

One, 259 mm. Not at all like Barnard's "*B. stellatus*" his pl. 36, fig. 3, which is the same as *B. flavimarginatus* Rüppell. In the present species the least depth of the caudal peduncle is less than the eye.

*Odonus erythron* (Günther).

One, 355 mm.

## MONACANTHIDAE

*Cantherines arenaceus* Barnard. Figure 37.

Depth  $1\frac{1}{2}$ ; head  $3\frac{1}{4}$ , width  $2\frac{2}{3}$ . Snout  $1\frac{1}{10}$  in head; eye 5,  $5\frac{1}{10}$  in snout,  $1\frac{1}{3}$  in interorbital; mouth small, terminal; interorbital  $3\frac{2}{3}$ , well elevated convexly. Gill opening  $1\frac{1}{2}$  times eye.

Skin minutely asperous, rough to touch, scales scarcely distinct. Lateral line not evident.

D. III — 35, second spine finely asperous, length  $1\frac{1}{2}$  in head, sixth ray  $2\frac{1}{2}$ ; A. 30, sixth ray  $2\frac{1}{2}$ ; caudal  $1\frac{2}{3}$ , convex behind; least depth of caudal peduncle  $2\frac{1}{4}$ ; pectoral  $2\frac{1}{3}$ , rays 13; pubic spine immovable, with short strong spinules; row of short, inconspicuous spines along each hind edge of dorsal spine.

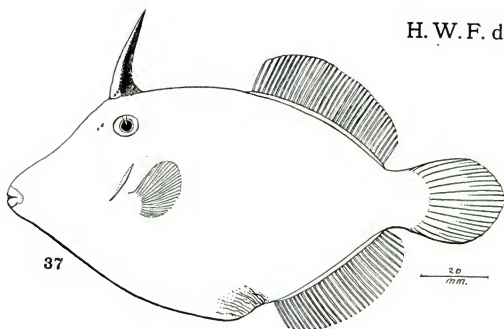
Body and head gray brown, caudal olive. Dorsal, anal and pectoral whitish, though dorsal spine and membrane gray brown.

One, 153 mm.

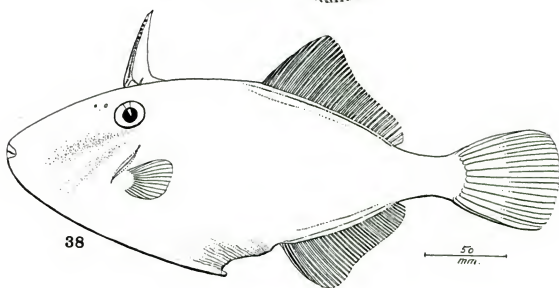
*Cantherines modestoides* Barnard. Figure 38.

One, 333 mm. "Purplish brown, lighter towards belly, with slaty black longitudinal lines running through to caudal. Fin membranes faint blue, rays olive, with gamboge tips. Along belly up to below mandible dark yellow, deeper on cheeks. Dorsal membrane deep lemon yellow. Caudal pale blue and white. Pectoral dark olive, white at base."

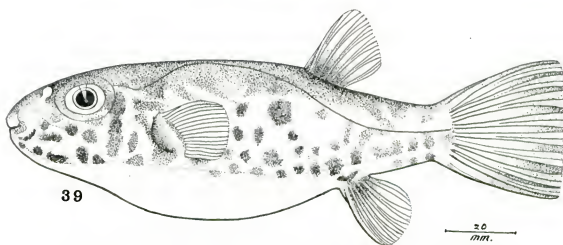
H. W. F. del.



37

20  
mm.

38

50  
mm.

39

20  
mm.37. *Cantherines arenaceus*.38. *Cantherines modestoides*.39. *Sphoeroides pleurospilus*.

## TETRODONTIDAE

**Sphoeroides pleurospilus** (Regan). Figure 39.

Depth  $2\frac{1}{2}$ ; head 3, width  $1\frac{1}{3}$ . Snout  $2\frac{1}{4}$  in head; eye  $3\frac{1}{3}$ ,  $1\frac{2}{3}$  in snout,  $1\frac{1}{2}$  in interorbital; mouth width 4 in head, mouth little subterminal inferiorly; lips moderately fleshy; interorbital  $2\frac{2}{3}$  in head, low, nearly level. Gill opening about long as eye.

Entire upper surface and sides of body smooth. Spinous area only on belly from throat below eye to vent, none of spines extending upward above lower level of gill opening and pectoral base.

D. II, 6, first branched ray  $2\frac{1}{10}$  in head; A. II, 5, first branched ray  $1\frac{1}{3}$ ; caudal  $1\frac{1}{3}$ , convex behind; least depth of caudal peduncle  $2\frac{2}{3}$ ; pectoral 2, rays 16.

Brown above, with obscure darker blotches which extend all down along sides. Iris gray. Fins brownish, hind portion of caudal and basal part of anal dusky.

One, 164 mm.

**Tetrodon stellatus** Schneider.

Two, 120 to 223 mm. This is *T. acrostaticus* Jenyns as described by Barnard, without type locality.

## DIODONTIDAE

**Diodon hystrix** Linnaeus.

One, 118 mm. Black band across interorbital, another broader, parallel, posterior; black blotch above each pectoral and posteriorly larger black blotch, besides still another close before dorsal.

## LOPHIIDAE

**Chirolophus insidiator** Regan.

One, 153 mm. Natal coast, in 210 fathoms. D. VI — 8.

## ANTENNARIIDAE

**Histrio histrio** (Linnaeus).

One, 168 mm. "Pinkish white, with numerous spots and irregular stripes of dark green."

## CHAUNACIDAE

**Chaunax pictus** Lowe.

One, 190 mm. Southeast of Natal, in 235 fathoms.

## A NEW RACE OF *GARRULAX MONILIGER* FROM NORTHERN SIAM

BY RODOLPHE MEYER DE SCHAUENSEE.

The following new race of *Garrulax moniliger* can be very easily distinguished from any other known form by the paleness of its coloration. The series on which the race is founded is in fresh plumage. The description follows:

***Garrulax moniliger bakeri***, subsp. nov.,

Type: Adult male No. 112131 in the collection of the Academy of Natural Sciences of Philadelphia. Collected at Nawng Haw, Chieng Mai, northern Siam, January 26, 1933, by R. M. de Schauensee.

*Description:* Differs from all other known forms by the paleness of its coloration, both above and below.

From both *G. m. moniliger* (Hodgs.) and *G. m. fuscata* Baker, it differs in being very much paler above. The fore part of the crown is almost ashy and the rest of it olive with no brown fulvous tinge. The rufous collar on the hind neck is much paler than in either of the above-mentioned forms, and mixed with olive, rendering it less conspicuous. The back is olive very slightly tinged with fulvous, much more olive and less brown than in either *moniliger* or *fuscata*.

Below much whiter, less tinged with fulvous, the fulvous of the flanks much paler.

Central rectrices olive instead of fulvous. The tips of the tail feathers very pale buff instead of deep buff as in *fuscata*, or pure white as in *moniliger*. The black subterminal patch covering a larger area, and of a purer deeper black than in either *moniliger* or *fuscata*. Ear coverts white tipped with olive.

*Soft parts:* Iris light yellow; bill horn brown; feet and legs fleshy brown.

*Dimensions:* Wing 129.5 mm.; tail 143 mm.; culmen (exposed) 24 mm.; tarsus 44 mm.

*Distribution:* Northern Siam.

*Material examined:* Besides the type, 3 males and 1 female from Chieng Mai, northern Siam.

*Garrulax moniliger moniliger*, 1 Darjeeling; 3 Rungeet R., Sikkim; 2 Margherita, Assam; 1 Gunjong, 8 Guitang, N. Cachat.

*Garrulax moniliger fuscata*, 2 Pegu; 2 Lower Pegu; 1 Rangoon; 1 Tenasserim; 2 Ban Thung Luang, S.W. Siam.

*Garrulax moniliger mouhoti*, 1 Cambodia, 6 Eastern Siam.

*Garrulax moniliger melli*, 4 China.

*Garrulax moniliger schmakeri*, 13 Hainan.

*Remarks:* Baker's *G. m. leucotis* (B.B.O.C. ccxxvii, p. 8, 1917) described from eastern Siam was regarded as a synonym of *G. m. mouhoti*

by Kloss (Ibis, 1918, p. 232). Later Baker confirmed Kloss's view. (Journ. Nat. Hist. Soc. Siam, III, No. 3, p. 183, 1919.)

*G. m. mouhoti* Sharpe, *G. m. pasquieri* Del., *G. m. tonkinensis* Del., (the latter regarded as a synonym of *melli* by Bangs and Van Tyne, Field Mus. Pub. No. 290, Zool. Ser., XVIII, No. 3, p. 88, 1931) are all dark and very rufescent birds.

This new form is named in honor of E. C. Stuart Baker, without whose new edition of the bird section of the "Fauna of British India" the study of Siamese birds would be a most laborious task.

My thanks are due to the American Museum of Natural History for the opportunity of examining the fine series of the various forms of *G. moniliger* contained in the Rothschild collection.



## AN ANNOTATED LIST OF TWO COLLECTIONS OF GUATEMALAN BIRDS IN THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

BY M. A. CARRIKER, JR., AND RODOLPHE MEYER DE SCHAUENSEE.

The present paper is based on two collections of birds, the first having been made by Samuel N. Rhoads and Earl L. Poole in 1915, consisting of 704 skins, collected between the coast, near Puerto Barrios, and the Motagua Valley; at Lake Amatitlan, Gualan, Quirigua and El Pilar.

The second collection was made by the junior author in 1935, mostly in the highlands and west slopes of the mountains, and consisted of 408 skins. No report was ever published on the Rhoads and Poole collection, and since the two collections contain the greater portion of the known resident species and subspecies of the country it was decided that it would be of interest to workers on Central American birds to publish a complete list of them, together with a description of the localities and such critical notes as have come to our attention.

While working over these collections several forms were found which appear to be new to science, and their descriptions follow in their proper places.

Thanks are due to the authorities of the U. S. National Museum and to the Biological Survey for the privilege of making comparisons with material in their respective collections.

For the names of all North American migrants we have followed the latest edition of the A. O. U. Checklist, and for the resident species, as far as possible, those used by Ludlow Griscom in his monumental work "Distribution of Bird Life in Guatemala." In the descriptions of the new forms all names of colors which are capitalized are taken by direct comparison from Ridgway's "Color Standards and Color Nomenclature" (1912).

For the sake of convenience we have followed the same systematic sequence as used by Mr. Griscom.

### LIST OF LOCALITIES

Both of the collections reported upon in this paper, although made twenty years apart, were made during the same months of the year. These months were during the dry season, and therefore any remarks about the local conditions apply only to that particular period.

The localities at which birds were collected, and a short description of each follow:

*Alotenango* (4000 ft.)—A small town on the Pacific slope about twelve miles south of Antigua. It is surrounded by dry scrubby vegetation, many of the larger trees having been killed by lava from the last eruption of the Volcan de Fuego.

*Amatitlan* (4000 ft.)—A small town situated on a lake of the same name. The land all about it is under cultivation with but few trees or even bushes.

*Antigua* (5000 ft.)—A large town surrounded by the Volcanoes of Agua (12311 ft.), Fuego (13487 ft.), and Acatenango (12992 ft.). Coffee is grown in quantity here, and corn is grown up to about 7500 feet on the mountain side. Where forest is found about Antigua it is parched and thin.

*Chichoy* (10,000 ft.)—A mountain pass above Teepam. The vegetation is cloud forest, the trees all thickly covered with moss.

*Coban* (3500 ft.)—The capital of Alta Vera Paz. A region of continual rain and fine forest which we found to contain surprisingly few birds.

*El Pilar*—A few miles north of Quirigua, in the Caribbean lowlands. Rhoads and Poole collected in open marshy ground, covered with long grass.

*El Rancho* (900 ft.)—A small village in the middle of the arid section of the Motagua Valley. True desert conditions are encountered here, the ground being sparsely covered with cactus and small stunted trees and bushes.

*El Zapote* (2500 ft.)—A finca on the Pacific slope about twenty miles northwest of Escuintla. Not as dry as the highlands, and with more tropical vegetation where the land is not under bananas or coffee. Mr. and Mrs. Petersen very kindly put the junior author and his party up at El Zapote where many interesting birds were secured.

*Escuintla* (1000 ft.)—In the hot zone of the Pacific slope, surrounded by sugar-cane and other crops.

*Gualan*—A town at the eastern end of the arid Motagua Valley. A bit less arid however than El Rancho.

*Istapa*—A coastal town fifteen miles east of the Pacific port of San Jose.

*Guatemala City* (5000 ft.)—The capital of the country situated on a wide, well-cultivated plain.

*Marajuma*—A collection of about four houses situated at the upper end of the Montagua Valley, 30 miles west of El Rancho. A dry stream bed, bordered with green trees, affords splendid cover for the numerous birds.

*Mocá* (3500 ft.)—A coffee finca situated on the Pacific slope of the Volcan de Atitlan. Splendid evergreen forest surrounds the plantation and birds are very numerous. Mr. and Mrs. Gordon Smith very kindly put up the Junior author's party at their beautiful finca where they passed a most enjoyable and interesting week.

*Panajachel*—A small town on the northern shore of Lake Atitlan (5000 ft.). The vegetation on the north shore of the lake is very poor. Nothing but scrubby trees and long grass containing but few birds.

*Patulul*—Fifty miles west of Escuintla in the tropical zone.

*Quirigua*—A banana plantation surrounded by tropical forest. It is about 70 miles inland from Puerto Barrios, the main Caribbean seaport of Guatemala.

*San Augustin Acazuastlan*—A village on the lower slopes of the Sierra de las Minas, about fifteen miles northeast of El Rancho, in the forest zone.

*San Cristobal*—A village twenty miles southwest of Coban, in the rainy zone.

*Santa Elena*—A finca about eight miles west of Tecpam at 8500 ft. altitude.

*Santa Lucia*—A village between Escuintla and Patulul.

*Santa Rosa*—Thirty miles south of Coban in Baja Vera Paz. Much drier than Coban.

*Sierra de las Minas*—The range of mountains bordering the north side of the Motagua Valley.

*Tecpam*—A town situated at 7200 feet where the road begins to climb over the Chichoy.

*Volcan de Acatenango*—A volcano just north of Antigua.

*Yzabal*—A town on the shores of the lake of the same name 15 miles due north of Quirigua.

*Zacapa*—The main town on the Motagua valley desert forty miles east of El Rancho.

#### ACKNOWLEDGMENTS

Our thanks are due, in addition to Mr. and Mrs. Smith of Mocá, and Mr. and Mrs. Petersen of El Zapote, to Mr. Charles F. Myers, president of the International Railway of Central America, who did everything in his power to make our trip an interesting and comfortable one.

We also wish to take this opportunity to thank the officials of the Guatemalan Government for their helpfulness to us during our stay in Guatemala. Rarely in any country have we been treated by the government offices with more courtesy and efficiency.

The junior author was accompanied on the trip to Guatemala by his wife and Messrs. Brandon Barringer, Reginald Jacobs, and Valdemaro Fioravanti, all of whom gave valuable assistance. Colonel Ibarra assisted in the preparation of skins.

#### DISTRIBUTIONAL LIST OF SPECIES AND SUBSPECIES

##### Family TINAMIDAE

###### *Crypturellus soui meserythrus* (Sclater).

*Tinamus meserythrus* Sclater, P.Z.S., 1859, p. 392 (Playa Vincente, Mexico).

Quirigua, 2 ♀ ♀, March 19, 1915 (Rhoads and Poole).

##### Family CRACIDAE

###### *Oreophasis derbianus* Gray.

*Oreophasis derbianus* Gray, Genera of Birds, III, 1844, p. 485, t. 121 (Guatemala).

Chichoy, 10,000 feet, 1 ♀, March 1, 1935 (De Schauensee).

Natives reported the species fairly common in this vicinity, but it is now very locally distributed, due to deforestation, and native hunters.

###### *Ortalis vetula plumbiceps* (Gray).

*Ortalis plumbiceps* Gray, List Gallinae Brit. Mus., 1867, p. 11 (Honduras and Guatemala).

Gualan, 1 ♀, Feb. 19, and Quirigua, 1 (no sex), March 9, 1915 (Rhoads and Poole).

## Family COLUMBIDAE

**Columba rufina pallidicrissa** Chubb.

*Columba pallidicrissa* Chubb, Ibis, 1910, p. 60 (Costa Rica).

Quirigua, 1 ♂, March 4, 1915 (Rhoads and Poole).

**Zenaidura macroura marginella** (Woodhouse).

*Ectopistes marginellus* Woodhouse, Proc. Acad. Nat. Sci. Phila., VI, 1852, p. 104 (Oklahoma).

Below Alotenango (4000 feet), 1 ♂, Feb. 9, 1935 (De Schauensee); Gualan, 1 ♂ and 1 ♀, Feb. 9 and 14, 1915 (Rhoads and Poole).

**Scardafella inca** (Lesson).

*Chamaepelia inca* Lesson, Descr. Mam. et Ois., 1847, p. 211 (Mexico).

Gualan, 1 ♂ and 2 ♀♀ and 1 (indet.), Feb. 9 and 24, 1915 (Rhoads and Poole).

**Melopelia asiatica asiatica** (Linnaeus).

*Columba asiatica* Linnaeus, Syst. Nat., 10th. Ed., I, 1758, p. 163 ("East Indies" = Jamaica).

Gualan, 2 ♀♀, Feb. 15 and 22, 1915 (Rhoads and Poole); El Rancho, 1 ♂, Feb. 17, 1935 (De Schauensee).

**Columbigallina passerina pallescens** (Baird).

*Chamaepelia* var. *pallescens* Baird, Proc. Acad. Nat. Sci. Phila., 1859, p. 305 (Cape San Lucas).

Gualan, 1 ♂ and 1 ♀, Feb. 27, 1915 (Rhoads and Poole).

**Columbigallina rufipennis rufipennis** (Bonaparte).

*Chamaepelia rufipennis* Bonaparte, Compt. Rend., XL, 1855, p. 22 (Cartagena, Colombia).

Gualan and Quirigua, 2 ♂♂ and 1 ♀, Feb. 15 and March 9, 1915 (Rhoads and Poole).

**Leptoptila verreauxi fulviventris** Lawrence.

*Leptoptila fulviventris* Lawrence, Ann. N.Y. Acad. Sci., II, No. 9, 1882, p. 287 (Yucatan).

Gualan, 3 ♀♀, Feb. 12 to 27; Quirigua, 1 ♂, March 22, 1915 (Rhoads and Poole); Zacapa, 1 (indet.), Feb. 15, 1935 (De Schauensee).

**Leptoptila plumbeiceps plumbeiceps** Sclater and Salvin.

*Leptoptila plumbeiceps* Sclater and Salvin, P.Z.S., 1868, p. 59 (Vera Paz, Guatemala).

Quirigua, 1 (indet.), March 12, 1915 (Rhoads and Poole).

**Leptoptila cassini cerviniventris** Sclater and Salvin.

*Leptoptila cerviniventris* Sclater and Salvin, P.Z.S., 1868, p. 59 (Vera Paz, Guatemala).

Quirigua, 2 ♂♂ and 1 ♀; El Pilar, 1 ♂, March 17 to 26, 1915 (Rhoads and Poole).

Family **RALLIDAE****Aramides albiventris albiventris** Lawrence.

*Aramides albiventris* Lawrence, Proc. Acad. Nat. Sci. Phila., 1867, p. 234 (Guatemala).

Quirigua, 2 ♀ ♀, April 3, 1915 (Rhoads and Poole).

Family **CHARADRIIDAE****Oxyechus vociferus vociferus** (Linnaeus).

*Charadrius vociferus* Linnaeus, Syst. Nat., Ed. 10, I, 1758, p. 150 (South Carolina).

Gualan, 1 ♀, Feb. 19, 1915 (Rhoads and Poole).

**Tringa solitaria solitaria** Wilson.

*Tringa solitaria* Wilson, Amer. Orn., VII, 1813, p. 53 (Pennsylvania).

Gualan, 1 ♀, Feb. 18, 1915 (Rhoads and Poole).

**Actitis macularia** (Linnaeus).

*Tringa macularia* Linnaeus, Syst. Nat. I, 1766, p. 249 (Pennsylvania).

Quirigua, Gualan and Zacapa, 2 ♂ ♂, 2 ♀ ♀ and 1 (indet.), Feb. 13 to March 16, 1915 (Rhoads and Poole).

Family **JACANIDAE****Jacana spinosa spinosa** (Linnaeus).

*Fulica spinosa* Linnaeus, Syst. Nat., I, 1758, p. 152 ("Cartagena").

El Pilar, 2 ♂ ♂ and 3 ♀ ♀, March 26 and 27, 1915 (Rhoads and Poole).

Family **ARDEIDAE****Butorides virescens virescens** (Linnaeus).

*Ardea virescens* Linnaeus, Syst. Nat., 1758, I, p. 144 ("America").

Quirigua, 1 ♀, March 17; Gualan, 1 ♀, Feb. 19, 1915 (Rhoads and Poole).

Family **FALCONIDAE****Circus hudsonius** (Linnaeus).

*Falco hudsonius* Linnaeus, Syst. Nat., I, 1766, p. 128 (Hudson Bay).

Quirigua, 1 ♀, March 11, 1915 (Rhoads and Poole).

**Buteo magnirostris direptor** Peters and Griscom.

Proc. N. E. Zool. Club, XI, 1929, p. 46 (Finca El Cipres, near Mazatenango, Pacific slope, Guatemala).

Quirigua, 2 ♂ ♂ and 1 ♀, March 4 to 15, 1915 (Rhoads and Poole).

**Busarellus nigricollis** (Latham).

*Falco nigricollis* Latham, Index Orn., I, 1790, p. 35 (Cayenne).

Quirigua, 1 ♀, March 10, 1915 (Rhoads and Poole).

**Ictinia plumbea** (Gmelin).

*Falco plumbeus* Gmelin, Syst. Nat. I, 1758, p. 283 (Cayenne).

Quirigua, 1 ♂, March 26, 1915 (Rhoads and Poole).

**Falco albigularis** Daudin.

Traité d'Orn., II, 1800, p. 131 (Cayenne).

Quirigua, 1 ♂, March 4, 1915 (Rhoads and Poole).

**Falco sparverius sparverius** Linnaeus.

*Falco sparverius* Linnaeus, Syst. Nat. Ed. 10, I, 1758, p. 90 (South Carolina).

Quirigua, 1 ♂, March 4, 1915 (Rhoads and Poole); Tecpam, 7,200 feet, 1 ♂, March 3 and Guatemala City, 1 ♀, March 13, 1935 (De Schauensee).

Family **BUBONIDAE****Ciccaba virgata centralis** Griscom.

Bull. Mus. Comp. Zool., LXVI, 1929, p. 159 (Chivelá, Oaxaca, Mexico).

Yzabal, 1 ♂, 1935 (De Schauensee).

**Glaucidium brasilianum ridgwayi** Sharpe.

*Glaucidium ridgwayi* Sharpe, Ibis, 1875, p. 55 (Mexico).

Gualan, 3 ♂, 1 ♀ and 1 indet., Feb. 9 to 24, 1915 (Rhoads and Poole); Marajuma, 1 ♂, Feb. 23, 1935 (De Schauensee).

Family **PSITTACIDAE****Aratinga strenua** (Ridgway).

*Conurus holochlorus strenuus* Ridgway, Proc. Biol. Soc. Wash., XXVII, 1915, p. 106 (Omotepe, Nicaragua).

Patulul, 1 ♂ and 2 ♀, March 7, 1935 (De Schauensee).

This little known parrot is easily distinguished from *A. rubritorquis* by its much heavier bill.

**Aratinga rubritorquis** (Selater).

*Conurus rubritorquis* Selater, P.Z.S., 1886, p. 538 ("South America" or "West Indies").

Gualan, 2 ♂ and 2 indet., Feb. 9 to 24, 1915 (Rhoads and Poole).

**Aratinga canicularis canicularis** (Linnaeus).

*Psittacus canicularis* Linnaeus, Syst. Nat., I, 1758, p. 98 (America; western Costa Rica by Bangs and Peters).

Gualan, 2 ♂ and 1 ♀, Feb. 11 to 13, 1915 (Rhoads and Poole); Marajuma and El Rancho, 1 ♂ and 1 ♀, Feb. 17, 23; Patulul, 1 ♂, March 7, 1935 (De Schauensee).

**Amazona auropalliata** (Lesson).

*Psittacus auropalliatu*s Lesson, Rev. Zool., 1842, p. 135 (Realejo, Nicaragua).

Istapa, 1 ♀, 1935 (De Schauensee).

**Amazona autumnalis autumnalis** (Linnaeus).

*Psittacus autumnalis* Linnaeus, Syst. Nat., I, 1758, p. 102.

Quirigua, 1 ♂ and 1 ♀, March 3 and 18, 1915 (Rhoads and Poole).

**Amazona albifrons nana** Miller.

Bull. Amer. Mus. Nat. Hist., XXI, 1905, p. 349 (Calotumul, Yucatan).

Marajuma, 2 ♂ ♂, Feb. 23, 1935 (De Schauensee).

Common in the Motagua valley desert, not seen elsewhere.

**Pionus senilis senilis** (Spix).

*Psittacus senilis* Spix, Aves Bras., I, 1824, p. 42 (Vera Cruz, Mexico, desig. by Griscom).

Gualan, 1 ♂ and 1 indet., Feb. 24, 1915 (Rhoads and Poole).

**Pyrilia haematotis haematotis** (Sclater and Salvin).

*Pionus haematotis* Sclater and Salvin, P.Z.S., 1860, p. 300 (Vera Paz, Guatemala).

Quirigua, 1 ♂ and 1 ♀, March 3, 1915 (Rhoads and Poole).

Family **ALCEDINIDAE****Chloroceryle amazona** (Latham).

*Alcedo amazona* Latham, Index Orn., I, 1790, p. 257 (Cayenne).

Quirigua, 2 ♂ ♂ and 2 ♀ ♀, Feb. 17 to April 3, 1915 (Rhoads and Poole).

**Chloroceryle americana isthmica** (Goldman).

*Ceryle americana isthmica* Goldman, Smiths. Misc. Coll., LVI, No. 27, 1911, p. 1 (Rio Indio, Canal Zone).

Quirigua and Gualan, 2 ♂ ♂ and 4 ♀ ♀, Feb. 17 to April 3, 1915 (Rhoads and Poole).

**Chloroceryle aenea stictoptera** (Ridgway).

*Ceryle superciliosa stictoptera* Ridgway, Proc. Biol. Soc. Wash., II, 1885, p. 95 (Sisal, Yucutan).

Quirigua, 2 ♀ ♀, March 6 and April 2, 1915 (Rhoads and Poole).

Family **MOMOTIDAE****Momotus lessonii lessonii** Lesson.

*Momotus lessonii* Lesson, Rev. Zool., V, 1842, p. 174 (Realejo, Nicaragua).

Quirigua, 2 ♂ ♂, 2 ♀ ♀ and 1 indet., March 9 to 29, 1915 (Rhoads and Poole); El Zapote, 1 ♂, Feb. 10, 1935 (De Schauensee).

**Momotus castaneiceps** Gould.

P.Z.S., 1854, p. 154 (Guatemala).

Gualan and Zacapa, 5 ♂ ♂, 1 ♀ and 2 indet., Feb. 15 to 26, 1915 (Rhoads and Poole); El Rancho and Marajuma, 2 ♂ ♂ and 5 ♀ ♀, Feb. 17 to 23, 1935 (De Schauensee).

Very common in the Motagua valley desert. Not seen elsewhere.

***Eumomota superciliosa bipartita* Ridgway.**

Proc. Biol. Soc. Wash., XXV, 1912, p. 90 (Cacoprieto, Oaxaca).

Patulul, El Zapote, below Alotenango, 3 ♂ ♂ and 1 ♀, March, 1935 (De Schauensee).

***Eumomota superciliosa vanrossemi* Griscom.**

Proc. New Eng. Zool. Club, XI, 1929, p. 55 (Sacapulas, Rio Negro Valley, interior of Guatemala).

Gualan and Zacapa, 7 ♂ ♂ and 2 ♀ ♀, February, 1915 (Rhoads and Poole); El Rancho and Marajuma, 3 ♂ ♂ and 2 ♀ ♀, February, 1935 (De Schauensee).

***Eumomota superciliosa sylvestris*, subsp. nov.**

Type, ♂ adult, from Quirigua, Guatemala, altitude 150 feet. No. 64723 A.N.S.P., collected March 15, 1915 by S. N. Rhoads and E. L. Poole.

*Diagnosis:* Nearest to *E. s. superciliosa* of the Yucatan-Campeche region of Mexico, in the tawny chestnut wash of the under parts, except that the transition between the breast and abdomen is abrupt, not blended as in *superciliosa*. In other characters it is very different, not only from *superciliosa* but from the other allied races. The superciliary region is entirely caerulean blue (silvery Pale Caerulean Blue) with silvery white concealed at bases of feathers; pileum Hay's Green, with a considerable area of black on either side; occiput and nape about Winter Green, blending into the Kaiser Brown of the middle portion of the mantle; scapulars, lesser and median wing coverts and tertials Winter Green; the blue of the wing and tail of a deeper shade, without greenish tinge (near Porcelain Blue); black area at base of remiges more extensive, with the blue area correspondingly reduced (only about 25 mm. long); throat and breast near Deep Dull Yellow-Green, with a tawny wash, due to the subterminal portion of the feathers being dull cinnamon, which color shows through the green tips; the blue stripe bordering the black throat patch much darker in shade, without any silvery white tinge; the abdomen and crissum between Cinnamon Rufous and Hazel, changing abruptly from the green of the breast (not blended as in *superciliosa*); the wing formula is also different from that of *superciliosa*, having the longest primary 10 to 12 mm. longer than the longest tertial, as in *vanrossemi* and *bipartita*, while in *superciliosa* they are practically equal, giving the wing a totally different, rounded aspect at the tip; the mandible of the new race is more flattened basally than in *superciliosa*, giving the whole bill a more depressed appearance; the post-ocular chestnut patch is of a deeper shade, and extends backward to the end of the superciliary stripe.

*Remarks:* In addition to the type, two other males were taken at the same locality. The new race comes from the humid rain forest of the Caribbean lowlands, from whence the species has not heretofore been recorded. It is by far the most richly colored of all the races of *superciliosa*, as might be logically expected from its habitat.



No other race, excepting *superciliosa*, approaches it in the rich tawny chestnut wash of the throat and breast, and not even *superciliosa* has the superciliary stripe wholly blue.

Compared with a large series of *vanrossemi* from Gualan, El Rancho and Marajuma; with six skins of *bipartita* from El Zapote, Alotenango and Patulul; with two skins of *superciliosa* from Tunkas and Tekanto (Yucatan); with six skins of *apiastur* from Cantarranas, Honduras; and one topotype of *euroastris* from Lancetilla, Honduras.

The skins from Gualan are not typical *vanrossemi*, being slightly intermediate with the new race, *sylvestris*, being duller green and having the belly darker chestnut, but they are much closer to *vanrossemi* and should bear that name.

*Measurements*: Three ♂♂, including the type: Wing, 107, 105, 111 mm.; tail, 220, 218, 215 mm.; bill, 42.5, 43, 44.5 mm.

***Aspatha gularis* (Lafresnaye).**

*Prionites gularis* Lafresnaye, Rev. Zool., VII, 1840, p. 130 (Guatemala).

Guatemala, 1935, 1 skin without sex or exact locality (De Schauensee).

***Hylomanes momotula momotula* Lichtenstein.**

*Hylomanes momotula* Lichtenstein, Abh. König., Akad. Wissensch. Berlin 1838, p. 449 (Valle Real, Mexico).

Guatemala, 1935, 1 skin without sex or exact locality (De Schauensee).

Family **CAPRIMULGIDAE**

***Nyctidromus albicollis yucatanensis* Nelson.**

Proc. Biol. Soc. Wash., XIV, 1901, p. 171 (Tunkas, Yucatan).

Quirigua and Gualan, 3 ♂♂ and 4 ♀♀, Feb. 3 to March 10, 1915 (Rhoads and Poole).

***Nyctidromus albicollis intercedens* Griscom.**

Amer. Mus. Novit., No. 379, 1929, p. 8 (Tela, Honduras).

El Zapote (2500 ft.), 1 ♀, Feb. 10, 1935 (De Schauensee).

This bird is doubtfully referred here. Having but one specimen it is difficult to judge of the validity of *intercedens*. It is undoubtedly smaller and darker than the seven skins of *yucatanensis*. The type of *intercedens* is from Tela, Honduras, and yet the author says that it occurs only on the Pacific slope in Guatemala. It is rather difficult to reconcile this apparent discrepancy.

***Antrostomus vociferus vociferus* (Wilson).**

*Caprimulgus vociferus* Wilson, Amer. Orn., V, 1812, p. 71 (Eastern U.S.).

Coban, 1 ♂, February 21, 1935 (De Schauensee). This bird is undoubtedly a northern migrant.

**Antrostomus vociferus chiapensis** Nelson.

*Antrostomus chiapensis* Nelson, Auk, 1900, p. 261 (Comitan, Chiapas).

Moca (3050 ft.), 1 ♀, March 6, 1935 (De Schauensee). We have not been able to compare this skin with authentic *chiapensis*, but it agrees with the description of that race, which has been recorded from this locality.

**Chordeiles acutipennis texensis** Lawrence.

*Chordeiles texensis* Lawrence, Ann. Lyc. Nat. Hist. N. Y., VI, 1858, p. 167 (Texas).

Quirigua, 1 ♂ and 1 ♀, March 24, 1915 (Rhoads and Poole). These skins are indistinguishable from a series of specimens from Texas and Arizona, and are quite distinct from Panama birds.

Family **TROCHILIDAE****Phaethornis superciliosus longirostris** (Delattre).

*Ornismya longirostris* Delattre, Echo du Monde Savant, I, 1843, No. 5, col. 1070 (Guatemala).

Quirigua, 3 ♂ ♂ and 1 ♀, March 3 to April 2, 1915 (Rhoads and Poole).

**Phaethornis adolphi saturatus** Ridgway.

Proc. Biol. Soc. Wash., XXIII, 1910, p. 54 (El Hogar, Costa Rica).

Quirigua, 1 ♂, 1 ♀ and 1 indet., March 4 to 6, 1915 (Rhoads and Poole). These skins, when compared with Panama birds (presumably typical *saturatus*), show a paler throat (more clearly cinnamon fulvous) and a slightly paler rufous chest. They seem to be intermediate between *adolphi* of Mexico and *saturatus*.

**Campylopterus rufus** Lesson.

Rev. Zool., 1840, p. 73 (loc. ignot.).

Volcan de Acatenango (6000 ft.), 1 skin, Feb. 11, 1935 (De Schauensee).

**Florisuga mellivora mellivora** (Linnaeus).

*Tochilus mellivorus* Linnaeus, Syst. Nat., I, 1758, p. 121 (Guiana).

Quirigua and El Pilar, 4 ♂ ♂ and 1 ♀, March 19 to 27, 1915 (Rhoads and Poole).

**Phaeochroa cuvierii roberti** (Salvin).

*Aphantochroa roberti* Salvin, P.Z.S., 1861, p. 203 (tierra caliente of Vera Paz, east Guatemala).

Quirigua, 1 ♂, March 16, 1915 (Rhoads and Poole).

**Agrytria candida candida** (Bourcier and Mulsant).

*Trochilus candidus* Bourcier and Mulsant, Ann. Sci. Phys. et Nat., Lyon, IX, 1846, p. 326 (Coban, Guatemala).

Quirigua, 1 ♂, March 24, 1915 (Rhoads and Poole).

**Saucerottia cyanura guatemalae** Dearborn.

*Saucerottia* (sic) *cyanura guatemalae* (sic) Dearborn, Field Mus. Nat. Hist. Publ. 126, 1907, p. 97 (Mazatenango, Dept. of Suchitepequez, Guatemala).

Moca, 2 ♂ ♂, March 8 and 9, 1935 (De Schauensee).

**Saucerottia beryllina devillei** (Bourcier and Mulsant).

*Trochilus devillei* Bourcier and Mulsant, Rev. Zool., 1848, p. 272 (Guatemala).

Below Alotenango (4,000 feet), 1 ♂ and 1 ♀, Feb. 8, 1935 (De Schauensee).

The material before us shows that there are at least two well-marked races of this species in Guatemala, those inhabiting the western, or Pacific, slope of the mountains and those from the Motagua Valley desert, at least as far east as Gualan. Griscom mentions a bird from Quirigua which he says "is much darker and more richly colored than Pacific slope specimens, and the tail is much more purple." These characters are quite the opposite from those characterizing the Motagua Valley birds, and it may prove to be still a third race.

Since the type locality of *devillei* is unknown, it may be well to designate one. Unquestionably the description of *devillei* was made from a skin taken somewhere in western Guatemala, since the color of the tail leaves no doubt of that fact; we therefore designate Alotenango as the type locality. (On the western watershed at about 4,000 feet.)

The Motagua Valley birds are quite different from any known form, and are herewith described as new.

**Saucerottia beryllina motaguae**, subsp. nov.

Type, ♂ adult, from Marajuma, Motagua Valley, Guatemala, altitude about 1,000 feet. No. 121661, A.N.S.P., collected February 23, 1935, by Rodolphe M. de Schauensee.

*Diagnosis:* Somewhat intermediate between *S. b. devillei* and *S. b. beryllina* of Mexico, having the color of the tail and under parts more nearly resembling *beryllina*, with the wings as in *devillei*, but differs from both in having the tail distinctly tipped with cinnamon ochraceous and the lower back and rump with the feathers tipped with dull cinnamonaceous.

The upper parts are paler green than in *devillei*, but less golden bronze than in *beryllina*; the upper tail coverts are purplish, but not as dark as in *devillei*; the tail is golden bronze, with a slight purplish-coppery sheen, very much paler than in *devillei* and slightly paler than in *beryllina*; there is very little cinnamon at the bases of the remiges, about as in *devillei*; the under parts are more golden green (less blue-green) than in *devillei*, but less golden than in *beryllina*; the under tail coverts are paler than in either of the other races, with the whitish edging more apparent.

*Remarks:* In addition to the type there are 2 ♀ ♀ from Marajuma and 1 ♀ from Gualan. The females also differ from the females of the other two races in the presence of the cinnamon-ochraceous tips on the rectrices, and in the color of the tail, rump and upper back. The Gualan female is in poor condition, but it seems to be the same as the Marajuma birds, having the tail and lower back of the same color.

**Amizilis tzacatl tzacatl** (De la Llave).

*Trochilus tzacatl* De la Llave, Registro Trimestre, II, 1833, p. 48 (Mexico).

Quirigua, 5 ♂ ♂, March 4 and 17, 1915 (Rhoads and Poole).

**Amizilis rutila rutila** (Delattre).

*Ornismya rutila* Delattre, Echo du Monde Savant, I, 1843, No. 5, col. 1069 (Acapulco, Guerrero, Mexico).

Gualan, 3 ♂ ♂ and 2 ♀ ♀, Feb. 12 to 24, 1915 (Rhoads and Poole);  
Marajuma, 1 ♂ and 3 ♀ ♀, Feb. 22, 23, 1935 (De Schauensee).

**Amizilis rutila corallirostris** (Bourcier and Mulsant).

*Trochilus corallirostris* Bourcier and Mulsant, Ann. Sci. Phys. et Nat., Lyon, IX, 1846, p. 328 (Escuintla, Guatemala).

Patulul, 1 ♀, February, 1935 (De Schauensee).

We have compared a good series of skins of *rutila* from Honduras, Nicaragua, and Mexico, with those from Guatemala listed above. There is much variation in the intensity of the color of the under parts. Males are consistently darker than the females. The Honduras birds and some from east Guatemala are as dark below as the specimen from Patulul (*corallirostris*). There is, however, one character which seems to separate it from the whole series of *rutila*, and that is the color of the tips of the rectrices, which are dark purplish, without any bronze green tinge, while all the series of *rutila* are decidedly greenish.

**Amizilis cyanocephala guatemalensis** (Gould).

*Cyanomyia guatemalensis* Gould, Introd. Troch., 1861, p. 148 (Guatemala).

San Cristobal, 1 ♂ and Antigua (5200 ft.) 1 (?), Feb. 20 and 13, 1935 (De Schauensee).

**Hylocharis eliciae** (Bourcier and Mulsant).

*Trochilus eliciae* Bourcier and Mulsant, Ann. Sci. Phys. et Nat., Lyon, IX, 1846, p. 314 (locality unknown).

Gualan, 1 ♂, Feb. 24, 1915 (Rhoads and Poole).

Compared with six skins from Honduras, Nicaragua, Costa Rica and Panama. These six skins all have the tail and upper tail coverts the same, the former bright golden bronze below, more bronzy green above, and with the upper tail coverts decidedly coppery bronze.

The single Guatemalan skin listed above has the tail decidedly bronze green below and shining blue-green above on the apical half, with the basal half more bronzy, while the upper tail coverts are much more greenish, with only slight coppery reflections on the longest feathers. The type locality for the species is not known, but it is significant that in the same paper<sup>1</sup> that *H. eliciae* was described, appears the description of *Amizilis rutila corallirostris* from Escuintla, Guatemala. If other Guatemalan specimens of *H. eliciae* should prove to be the same as this Gualan skin,

<sup>1</sup> Ann. Sci. Phys. et Nat., Lyon, IX, 1846, p. 328.

they should be separated from the more southern birds, in which case it would seem logical that the southern race would be the one requiring a new name.

**Chlorostilbon caniveti osberti** Gould.

*Chlorostilbon osberti* Gould, P.Z.S., 1860, p. 309 (Guatemala).

Gualan, 3 ♂ and 5 ♀, Feb. 10 to 24, 1915 (Rhoads and Poole); Marajuma, 1 ♂, Feb. 23, 1935 (De Schauensee).

**Anthracothonax prevostii prevostii** (Lesson).

*Trochilus prevostii* Lesson, Hist. Nat. Colibris, 1830-1831, p. 87 (locality unknown).

Santa Lucia, 1 ♂ juv., March 6, 1935 (De Schauensee).

**Lamprolaima rhami** (Lesson).

*Ornismya rhami* Lesson, Rev. Zool., 1838, p. 315 (Mexico).

Chichoy, 1 ♂, March 1, 1935 (De Schauensee).

**Anthoscenus constantii leocadiae** (Bourcier and Mulsant).

*Trochilus leocadiae* Bourcier and Mulsant, Ann. Sci. Phys. et Nat., Lyon, IV, 1852, p. 141 (Mexico).

Gualan, 2 ♂, Feb. 24 to 27, 1915 (Rhoads and Poole).

These two skins are probably not quite typical *leocadiae*, showing a slight tendency towards the southern race, *constantii*.

**Anthoscenus longirostris pallidiceps** (Gould).

*Helimaster pallidiceps* Gould, Introd. Troch., 1861, p. 139 (Jalapa, Vera Cruz, Mexico).

Patulul, 1 ♂, March 7, 1935 (De Schauensee).

**Doricha enicura** (Vieillot).

*Trochilus enicurus* Vieillot, Nouv. Dict. d'Hist. Nat., XXIII, 1818, p. 429 ("Brazil").

Guatemala City, 1 ♂, Feb.; San Cristobal, 2 ♀, Feb. 20, 1935 (De Schauensee).

**Archilochus colubris** (Linnaeus).

*Trochilus colubris* Linnaeus, Syst. Nat., I, 1758, p. 120 (Carolina to New England).

Sierra de Las Minas (5,000 feet) and Marajuma, 3 ♀, Feb. 22, 23, 1935 (De Schauensee).

**Abeillia abeillei** (Delattre and Lesson).

*Ornismya abeillei* Delattre and Lesson, Rev. Zool., 1839, p. 16 (Mexico).

Moca, 1 ♀, March 8, 1935 (De Schauensee).

Family **TROGONIDAE**

**Trogon mexicanus** Swainson.

Philos. Mag., (N.S.) I, 1827, p. 440 (Temiscaltepec, Mexico).

Santa Elena (8,500 feet), 1 ♂, Feb. 28, 1935 (De Schauensee).

**Trogon elegans elegans** Gould.

*Trogon elegans* Gould, P.Z.S., 1834, p. 26 (Guatemala or Mexico).

Gualan, 5 ♂ ♂ and 3 ♀ ♀, Feb. 6 to 25, 1915 (Rhoads and Poole); Marajuma, 4 ♂ ♂ and 2 ♀ ♀, Feb. 22 to 24, 1935 (De Schauensee).

This beautiful Trogon was found to be not at all uncommon in the fringe of trees bordering the water courses of the arid valley of the Motagua throughout its length.

**Trogon collaris puella** Gould.

*Trogon puella* Gould, P.Z.S., 1845, p. 18 (Escuintla, Guatemala).

Volcan de Acatenango, 6,000 feet, 2 ♂ ♂, Feb. 12, 1935 (De Schauensee).

**Trogon melanocephalus melanocephalus** Gould.

*Trogon melanocephalus* Gould, Mon. Trogonidae, 1st. Ed., 1838, Pl. XII (Tamaulipas, Mexico).

Quirigua, 6 ♂ ♂ and 2 ♀ ♀, Feb. 12 to March 19, 1915 (Rhoads and Poole); Yzabal, 1 ♂ and 1 ♀, 1935 (De Schauensee).

**Trogon violaceus braccatus** (Cabanis and Heine).<sup>2</sup>

*Aganus braccatus* Cabanis and Heine, Mus. Heine, IV, 1863, p. 184 (Mexico).

Gualan, 3 ♂ ♂ and 1 ♀, Feb. 11 to 22, 1915 (Rhoads and Poole); Moca, 1 ♂, March 8, 1935 (De Schauensee).

This skin from Moca, which is on the Pacific slope, is slightly different from all specimens from east Guatemala, Mexico, Honduras and Nicaragua, which we have examined. The whole pileum, nape and sides of neck are dull blue-black, with only the faintest trace of shining blue at the extreme lower edge of the nape, bordering the green of the mantle. The bird is fully adult and in full, fresh plumage. No other skins from western Guatemala are available for comparison. It is possible that birds from this region may constitute a distinct race.

**Trogon massena massena** Gould.

*Trogon massena* Gould, Mon. Trogonidae, 1st. Ed., 1838, Pl. XVI (Guatemala).

Quirigua, 1 ♂, March 13; Yzabal, 1 ♂, 1935 (De Schauensee).

## Family CUCULIDAE

**Piaya cayana thermophila** Sclater.

*Piaya thermophila* Sclater, P.Z.S., 1859, p. 368 (Jalapa, Vera Cruz).

Gualan, 4 ♂ ♂, 1 ♀ and 2 indet., Feb. 13 to 26; Quirigua, 1 ♂ and 1 ♀, March 15, 17, 1915 (Rhoads and Poole); Volcan de Acatenango (6,000 ft.), 1 ♂, Feb. 12 and Marajuma, 1 ♀, Feb. 23, 1935 (De Schauensee).

<sup>2</sup> We are not fully convinced that the evidence given by Van Rossem is sufficient for changing the name of this species to *T. caligatus sallaei* Bonaparte. The male type of *sallaei* has disappeared, and his contention is based entirely on the female cotype, which may or may not represent the same bird as the lost male. (Bull. Mus. Comp. Zool., Vol. LXXVII. No. 7, p. 392, 1934.)

The single male from the Volcan de Acatenango is much darker and more richly colored than the others, having the tips of the remiges and the subterminal portion of the rectrices deep black, the latter of greater extent, while the wings and tail are strongly glossed with dark, rich claret color. Specimens from Honduras approach this skin in the intensity of color, but are not so dark. The series from the Motagua Valley match Yucatan specimens and are uniformly much paler throughout, with almost no claret sheen, and the black of the remiges and rectrices is much paler and duller.

***Geococcyx velox affinis* Hartlaub.**

*Geococcyx affinis* Hartlaub, Rev. Zool., 1844, p. 215 (no locality, but probably the highlands of Guatemala).

Panajachel, 1 ♂, Feb. 1, 1935 (De Schauensee).

This skin has been compared with a series of skins of *velox* from Mexico (Oaxaca, Sinaloa, Jalisco, Tepic), also with 3 ♂ and 1 ♀ from San Juancito, Honduras. The birds from the highlands of Guatemala are undoubtedly different from those of Mexico and Hartlaub's name of *affinis* will apply to them. There is little doubt that Hartlaub's type came from the mountains of Guatemala, since all the other Guatemalan species described by him in the same paper are only known from the highlands of that country. Moore has described the bird from Honduras and Nicaragua under the name of *G. v. longisignum*,<sup>3</sup> giving as differentiating characters (from *affinis*), longer white tips on the three outer rectrices, absence of black subterminal bar on outer rectrix and the gray area on the second rectrix much larger, with back darker brown etc. Our four skins from Honduras do not entirely bear out his conclusions in the matter of the color pattern of the tail. Three out of four skins have a black subterminal bar, in one as wide as Guatemala birds, but the gray patch on the second rectrix conforms to his statement. It is possible that further south the black subterminal band entirely disappears and that the San Juancito birds are slightly intermediate. On the whole *G. v. longisignum* seems to be a good, though not strongly characterized race.

There is another section of Guatemala from which specimens of *Geococcyx velox* seem to have been previously wanting, or else too few to call the attention of other workers in this field. We refer to the arid Motagua valley of the eastern side of the country. We have 2 ♂ from Gualan and 1 ♀ from Marajuma, together with 2 ♂ from Tekanto, Yucatan, which are quite different from either *velox* of Mexico or *affinis* of the highlands of Guatemala, in that they are very pale below, nearly white. These five birds apparently constitute an undescribed race, which is described below under the name of *G. v. pallidus*.

<sup>3</sup> A Review of the Races of *Geococcyx velox*, by Robt. T. Moore, Trans. San Diego Soc. Nat. Hist., VII, 1934, p. 455.

***Geococcyx velox pallidus*, subsp. nov.**

Type, ♂ adult, from Gualan, Motagua Valley, Guatemala, No. 63745, A.N.S.P., collected February 17, 1915 by S. N. Rhoads and E. L. Poole.

*Diagnosis*: Nearest to and resembling *G. v. melanchima* of Mexico in the pale color of the under parts, but nearer to *affinis* in the characters of the tail, but differing from both in the following respects:

Pileum more densely spotted with white, especially on the front, and with the spots averaging smaller (than both *velox* and *melanchima*); under parts much paler than even *melanchima*, the whole area being white with the exception of the foreneck and flanks, which are cream color; the crissum light brown, paler than in *affinis*; tarsi and toes of the same length, but considerably thicker and heavier; bill longer (averaging 2 mm. longer from nostril to tip) and heavier and with the tip of the maxilla more decurved, and overhanging the tip of the mandible by not less than 1 mm., giving the bill a decidedly hooked appearance. (The tips of the maxilla and mandible are practically even in *affinis* and not strongly decurved, but in *velox* the bill is almost like that of *pallidus*.)

*Measurements*:

	wing.	tail.	culmen.
♂ Gualan (type).....	151 mm.	307 mm.	49.5 mm.
♂ ".....	145	(imperfect)	
♀ Marajuma.....	144	293	44
♂ Tekanto, Yucatan.....	144	(imperfect)	45.5
♂ " ".....	143.5	277	48

*Remarks*: The two males and a female from Gualan and Marajuma and the two males from Tekanto are very uniform in the color of the body. They may be picked out at a glance from a series of *velox* or *affinis*. The character of the tail pattern, upon which Mr. Moore lays so much stress, does not appear to be constant. Four out of the five birds have the black subterminal bar on the outer rectrix present and ranging from 8 to 12 mm. wide (along the rib), while in the fifth it is entirely absent (a ♂ from Gualan). Three birds have very little gray on the basal portion of the second rectrix, while one has a large patch on one side and almost none on the other, and the skin which has no black subterminal bar has as much gray on the second rectrix as Honduras birds (*longisignum*). The presence of a distinct race of the Roadrunner inhabiting the semi-arid lowlands is not unusual, in fact rather to be expected, while its pale coloration conforms to that of the usual run of races found in similar localities.

The range of *G. v. pallidus* apparently covers the semi-arid lowlands of eastern Guatemala and Yucatan.

***Morococcyx erythropygus macrourus* Griscom.**

Amer. Mus. Novit., No. 414, 1930, p. 2 (Progreso, Guatemala).

Gualan, 1 ♂, 1 ♀ and 1 indet., Feb. 13 to 26, 1915 (Rhoads and Poole); Yzabal, 1 ♂, 1935 (De Schauensee).



The male from Yzabal is a skin which was collected by a native collector and was "said" to have come from this locality, but it is very doubtful, since Yzabal is in the rain forest region of the eastern lowlands, where the species apparently is not found.

***Tapera naevia excellens* (Sclater).**

*Diplopterus excellens* Sclater, P.Z.S., 1857, p. 229 (S. Mexico).

Gualan, 1 ♂ Feb. 12, 1915 (Rhoads and Poole); Yzabal, 1 ♀, Feb., 1935 (De Schauensee). A handsome, richly colored bird, quite distinct from the South American races.

***Crotophaga sulcirostris sulcirostris* Swainson.**

*Crotophaga sulcirostris* Swainson, Philos. Mag., (N.S.) I, 1827, p. 440 (Mexico).

Gualan, 3 ♀ ♀, Feb. 12 to 27; Lake Amatitlan, 1 indet., Feb. 3; Quirigua, 2 ♀ ♀, March 12 to 15, 1915 (Rhoads and Poole); Coban, 1 ♂ and 1 ♀, Feb. 21, 1935 (De Schauensee).

Family **RAMPHASTIDAE**

***Ramphastos sulfuratus intermedius*, subsp. nov.**

Type, ♂ adult, from Quirigua, Guatemala. No. 63729, A.N.S.P., collected March 15, 1915, by S. N. Rhoads and E. L. Poole.

*Diagnosis*: Intermediate between *R. s. sulfuratus* of northern Guatemala and Mexico and *R. s. brevicarinatus* of Nicaragua, Panama and Colombia.

The bill is very similar to that of *sulfuratus* in color, but averages smaller, about the same as in birds from Nicaragua and Panama (but not those from Colombia); the principal distinguishing character being the width of the red border along the posterior edge of the yellow throat, which is always well marked and unbroken, but never more than half the width of this band in *brevicarinatus*, while most of the red feathers are tipped with black, which is not the case in the southern race.

Ridgway gives the average length of wing for 6 ♂ ♂ from Vera Cruz as 213 mm., and bill as 156.7 mm. Three ♂ ♂ in the Academy collection from Jalapa and Vera Cruz measure 218 mm. for wing and 155 mm. for bill. Van Tyne gives the average measurements for Peten (Uaxactun) males as 199.1 mm. for wing and 140.5 mm. for bill. Our males from Nicaragua, Costa Rica, and Panama, average, wing, 202 mm. and bill, 127 mm.

Our males from Guatemala and Honduras (*R. s. intermedius*) average, wing, 197 mm. and bill, 126 mm. Three females from Guatemala (Quirigua) average, wing, 191.6 mm. and bill, 121 mm.

*Remarks*: Gould's type of *brevicarinatus* is obviously a young bird, having the bill short and spongy and lacking definite color pattern. There is no question but that it is a bird which came from somewhere between Nicaragua and Colombia, for it has the red breast band well developed, even for a young bird, although the label bears the word "Mexico".

There is some doubt in our minds about this being Gould's type. The word "type" on the label was obviously written there at a much later date than the rest of the label, the ink being different and the writing certainly not that of Mr. Gould, while his figures for the species were certainly not made from a young bird. Neither does Gould make any mention of Mexico in his description of the species.

In Mr. Griscom's "Distribution of Bird Life in Guatemala" he says of this bird: "In the red border to the yellow breast, all Guatemalan specimens, even from Alta Vera Paz, are definitely the southern race. In size of the bill, variation is enormous in this family and none of the Guatemala specimens attains even the maximum size recorded for examples from much further south. I see no point, therefore, in including Guatemala in the range of *sulfuratus*."

Mr. Van Tyne, in his recent report on the "Birds of Northern Peten" (Univ. Mich. Misc. Pub. No. 27, 1935, p. 22), disagrees entirely with Mr. Griscom, and calls the birds of northern Peten "*sulfuratus*".

We think that both Messrs. Griscom and Van Tyne are partially right and partially wrong in their contentions, and that the true state of affairs seems to be that the birds of northern Peten are perhaps (we have not examined them) referable to *sulfuratus*, but slightly intermediate with the Guatemala race of *intermedius*, as their measurements show. However, Mr. Van Tyne asserts that they are precisely like specimens of *sulfuratus* in color, so that they apparently lack the well-marked red breast band so characteristic of the birds from central Guatemala to Honduras.

Mr. Van Tyne is in error when he refers all Guatemalan birds to *sulfuratus*, and Mr. Griscom, we think, is equally in error in referring them to *brevicarinatus*, when they differ so radically from that race in the width of the red breast band.

It seems to us that the simplest manner of settling the controversy is to give the birds from central Guatemala to Honduras a name of their own, which they so obviously need, and which should be satisfactory to all parties concerned.

**Pteroglossus torquatus torquatus** (Gmelin).

*Rhamphastos torquatus* Gmelin, Syst. Nat., I, 1788, p. 354.

Gualan, 1 ♂ and 1 ♀, Feb. 19; Quirigua, 2 ♂ ♂ and 2 ♀ ♀, Mar. 16 to 19, 1915 (Rhoads and Poole).

#### Family GALBULIDAE

**Galbula melanogenia** Sclater.

Jardine's Contrib. Orn., 1852, p. 61 (no locality).

Quirigua, 6 ♂ ♂ to 2 ♀ ♀, March 4 to 27, 1915 (Rhoads and Poole).

The birds from Quirigua have the throat rather blacker than a series of six males from Eden, east Nicaragua, but otherwise they are quite similar.

## Family BUCCONIDAE

**Malacoptila panamensis inornata** (Du Bus).

*Monasa inornata* Du Bus, Bull. Acad. Roy. Belg., XIV, 1847, p. 107 (Guatemala).

Quirigua, 1 ♂ and 2 ♀ ♀, March 12 to April 1, 1915 (Rhoads and Poole).

## Family PICIDAE

**Colaptes mexicanoides mexicanoides** Lafresnaye.

*Colaptes mexicanoides* Lafresnaye, Rev. Zool., 1844, p. 42 (Mexico).

Antigua, 1 ♂ and 1 ♀, Feb. 13, 1935 (De Schauensee).

These were the only two specimens seen.

**Picus rubiginosus yucatanensis** (Cabot).

*Picus yucatanensis* Cabot, Proc. Bost. Soc. N. H., I, 1844, p. 164 (Yucatan).

San Cristobal, Coban, 1 ♂ and 1 ♀, Feb. 19, 21, 1935 (De Schauensee).

**Picus rubiginosus maximus** Griscom.

Amer. Mus. Novit., No. 379, 1929, p. 11 (Chanquejelve, Huehuetenango, Guatemala).

Volcan de Acatenango, 6,000 ft., 1 ♀, Feb. 11, 1935 (De Schauensee).

**Picus rubiginosus differens** Griscom.

Amer. Mus. Novit., No. 379, 1929, p. 11 (Finca Carolina, Pacific slope of Guatemala).

Moca, 1 ♂ and 2 ♀ ♀, March 6 to 8, 1935 (De Schauensee).

**Balanosphyra formicivora lineata** Dickey and Van Rossem.

Proc. Biol. Soc. Wash., XL, 1927, p. 1 (Mt. Cacaguatique, Dept. San Miguel, Salvador).

Volcan de Acatenango, 6,000 ft., and Tecpam, 3 ♂ ♂ and 1 ♀, Feb. 11 and March 2, 1935 (De Schauensee).

**Centurus aurifrons santacruzi** Bonaparte.

*Centurus santacruzi* Bonaparte, P.Z.S., 1837, p. 116 (Guatemala; designated by Griscom as: Sta. Cruz de Quiché).

Quirigua, 3 ♂ ♂, March 4 to 12; Gualan, 3 ♂ ♂ and 1 ♀, Feb. 10 to 19, 1915 (Rhoads and Poole); El Zapote, 2 ♂ ♂ and 1 ♀, Feb. 10; Moca, 2 ♂ ♂, March 9; above Escuintla, 1 ♂ and 1 ♀, Feb. 8; Marajuma, 1 ♂ and 2 ♀ ♀, Feb. 23; El Rancho, 1 ♀, Feb. 17, 1935 (De Schauensee).

This series shows the usual amount of variation cited by Griscom. One ♂ from Quirigua has the abdomen quite reddish, the others, together with the Gualan birds, are reddish orange or old gold. The birds from El Zapote, Mocá and Marajuma have the abdomen yellowish and less in extent, while 1 ♂ from Zapote, 1 from above Escuintla and 1 from Mocá have the red of pileum more or less broken by a gray bar. The ♀ from El Rancho presents an interesting form of albinism, the whole pileum, sides of head, and under parts being white, with the front yellow, nape red; the abdomen orange red medially and slight dusky bars on flanks and under

tail coverts; the back and wings are dull grayish brown, with white bars, the apical half of the remiges being almost white; tail pale brown. One of the Gualan birds might be classed as *C. a. pauper*, agreeing perfectly with Honduras birds.

**Veniliornis oleaginus sanguinolentus** (Sclater).

*Chloronerpes sanguinolentus* Sclater, P.Z.S., 1859, p. 60 (Omoa, Honduras).

Guatemala, 1 ♀, 1935 (De Schauensee).

**Celeus castaneus** (Wagler).

*Picus castaneus* Wagler, Isis, 1829, p. 515 (Valle Real, Mexico).

Quirigua, 1 ♂ and 2 ♀ ♀, March 25 to 29, 1915 (Rhoads and Poole).

**Phloeocastes guatemalensis guatemalensis** (Hartlaub).

*Picus guatemalensis* Hartlaub, Rev. Zool., 1844, p. 214 (Guatemala).

Quirigua, 1 ♂, March 3; "Guatemala", 1 ♀, 1915 (Rhoads and Poole).

**Ceophloeus lineatus similis** (Lesson).

*Picus similis* Lesson, Compl. Œuvres Buffon, XX, 1847, p. 204 (San Carlos, Central America).

Quirigua, 4 ♂ ♂ and 1 ♀, March 6 to 25; Gualan, 1 ♂ to 3 ♀ ♀, Feb. 17 to 22, 1915 (Rhoads and Poole).

Family **FORMICARIIDAE**

**Taraba major melanocrissa** (Sclater).

*Thamnophilus melanocrissus* Sclater, P.Z.S., 1860, p. 252 (Orizaba, Vera Cruz, Mexico).

Quirigua, 4 ♂ ♂ and 3 ♀ ♀, March 9 to 27, 1915 (Rhoads and Poole).

**Thamnophilus doliatus intermedius** Ridgway.

*Thamnophilus intermedius* Ridgway, Proc. U. S. Nat. Mus., X, 1888, p. 581 (Truxillo, Honduras).

Quirigua, 4 ♂ ♂ and 3 ♀ ♀, March 16 to Apr. 3, 1915 (Rhoads and Poole).

**Cercomacra tyrannina crepera** Bangs.

*Cercomacra crepera* Bangs, Auk, 1901, p. 365 (Divala, Chiriqui, Panama).

Quirigua, 7 ♂ ♂ and 4 ♀ ♀, March 11 to April 2; El Pilar, 1 ♂, March 23, 1915 (Rhoads and Poole).

**Microrhophias boucardi boucardi** (Sclater).

*Formicivora boucardi* Sclater, P.Z.S., 1858, p. 300 (Acatepec, Oaxaca).

Quirigua, 2 ♂ ♂, March 23, 1915 (Rhoads and Poole); Yzabal, 1 ♂, 1935 (De Schauensee).

**Grallaria guatimalensis guatimalensis** Prevost and Des Murs.

*Grallaria guatimalensis* Prevost and Des Murs, Voy. Venus, Zool., p. 199 (Guatemala).

San Augustin, Acazaguastlan, 1935 (De Schauensee).

Family **FURNARIIDAE****Synallaxis erythrothorax erythrothorax** Sclater.

*Synallaxis erythrothorax* (part) Sclater, P.Z.S., 1855, p. 75 (Coban, Guatemala).

Quirigua, 2 ♂ ♂, 3 ♀ ♀ and 2 indet., March 12 to April 1, 1915 (Rhoads and Poole).

In a recent paper Van Rossem (Bull. Mus. Comp. Zoöl., LXXVII, No. 7, p. 413, 1934) has called attention to the fact that the plate illustrating the species was made from a Honduras specimen and the description following it was taken from a Guatemalan skin from Coban. He says that the Honduras bird (type of the plate) is darker than the Guatemalan bird, and since the named plate has precedence over the written description, the Guatemalan bird, if proven to be distinct, will have to be renamed.

We have five adult skins of this species from Quirigua, Guatemala and four from Lancetilla, Honduras, one adult and three immature. We admit that there is a very slight difference in shade of color between the two series, but it is not, in our opinion, sufficient to warrant separating the birds from Guatemala.

**Automolus ochrolaemus amusus** Peters.

Bull. Mus. Comp. Zoöl., LXIX, No. 12, Oct. 1929, p. 404.

Quirigua, 1 ♂, March 1, 1915 (Rhoads and Poole); Yzabal, 1 indet., 1935, (De Schauensee). Compared with two topotypes of *amusos*, with which they agree very closely. This is the first record of *A. o. amusus* for Guatemala.

Family **DENDROCOLAPTIDAE****Dendrocolaptes certhia sancti-thomae** (Lafresnaye).

*Dendrocolaptes sancti-thomae* Lafresnaye, Rev. Mag. Zool., 1852, p. 406 (corrected to Santo Tomas, near Omoa, Honduras, now Guatemala).

Quirigua, 1 ♂, March 15, 1915 (Rhoads and Poole).

This bird is very close to two specimens from eastern Nicaragua (Eden and Pis-pis River), but they are brighter, more cinnamon ochraceous below and with the pileum more ruddy. The base of the mandible is pale instead of blackish. The differences are not, however, sufficient to be of racial significance.

**Xiphorhynchus guttatus confinis** (Bangs).

*Dendroornis nana confinis* Bangs, Bull. Mus. Comp. Zoöl., XXXIX, 1903, p. 150 (Ceiba, coast of Honduras).

Quirigua, 1 ♂ and 1 ♀, March 10 and 12, 1915 (Rhoads and Poole).

The only perceptible differences between these and Honduras birds are the paler ribs of the rectrices.

**Glyphorhynchus spirurus pectoralis** Sclater and Salvin.

*Glyphorhynchus pectoralis* Sclater and Salvin, P.Z.S., 1860, p. 299 (Vera Paz, Guatemala).

Quirigua, 1 ♂, March 5, 1915 (Rhoads and Poole).

**Sittasomus griseicapillus sylvioides** Lafresnaye.

*Sittasomus sylvioides* Lafresnaye, Rev. Mag. Zool., 1850, p. 590 (Mexico).

Quirigua, 1 ♀ (Rhoads and Poole).

**Dendrocinclá anabatina anabatina** Sclater.

*Dendrocinclá anabatina* Sclater, P.Z.S., 1859, p. 54 (Omoa, Honduras).

Quirigua, 4 ♂ ♂, 2 ♀ ♀ and 1 indet., March 16 to April 1, 1915 (Rhoads and Poole); Yzabal, 1 indet., 1935 (De Schauensee).

Family **TYRANNIDAE****Tyrannus melancholicus chloronotus** Berlepsch.

*Tyrannus chloronotus* Berlepsch, Ornis, 1907, p. 474 (Temax, Yucatan).

Quirigua, 2 ♂ ♂, March 23 to 26; Gualan, 1 ♂, Feb. 24, 1915 (Rhoads and Poole); Coban, 1 ♂, Feb. 18 and El Rancho 1 ♂ and 1 ♀, Feb. 17, 1935 (De Schauensee).

**Tyrannus verticalis** Say.

In Long's Exped. Rocky Mts., II, 1823, p. 60 (near La Junta, Colorado).

Gualan, 1 ♀, Feb. 19, 1915 (Rhoads and Poole); above Amatitlan, 1 ♂, March 1, 1935 (De Schauensee).

**Legatus leucophaeus variegatus** (Sclater).

*Elainea variegata* Sclater, P.Z.S., 1856, p. 297 (Cordova, Vera Cruz, Mexico).

Quirigua, 1 ♂, March 25, 1915 (Rhoads and Poole).

**Myiodynastes luteiventris luteiventris** Sclater.

*Myiodynastes luteiventris* Sclater, P.Z.S., 1859, p. 42 (Vera Paz, Guatemala).

Quirigua, 1 ♂ and 1 indet., March 20 and April 1, 1915 (Rhoads and Poole).

**Megarhynchus pitangua mexicanus** (Lafresnaye).

*Scaphorhynchus mexicanus* Lafresnaye, Rev. Zool., 1861, p. 473 (Mexico).

Gualan, 1 ♂ and 1 ♀, Feb. 18 and 26, 1915 (Rhoads and Poole); below Alotenango, 1 ♂, Feb. 8 and Marajuma, 1 ♀, Feb. 23, 1935 (De Schauensee).

The Marajuma female should be, according to Griscom, *M. p. deserticola*, but we can detect no appreciable difference between it and the other three Guatemalan skins:

**Myiozetetes similis texensis** (Giraud).

*Muscicapa texensis* Giraud, Sixteen New Species Texas Birds, 1841 ("Texas").

Quirigua and Gualan, 2 ♂ ♂ and 3 ♀ ♀, Feb. 12 to March 25, 1915 (Rhoads and Poole); Coban, San Cristobal and Marajuma, 1 ♂ and 2 ♀ ♀, Feb. 18 to 23, 1935 (De Schauensee).

**Pitangus sulphuratus guatemalensis** (Lafresnaye).

*Saurophagus guatemalensis* Lafresnaye, Rev. Mag. Zool., 1852, p. 462 (Guatemala).

Quirigua, 2 ♂ ♂, March 3, 19; Gualan, 1 ♂ and 1 ♀, Feb. 13; San Pablo (near Zacapa), 1 ♂, Feb. 15, 1915 (Rhoads and Poole); Moca, 1 ♂, March 6, 1935 (De Schauensee).

**Pitangus sulphuratus pallidus** Griscom.

Am. Mus. Novit., No. 414, 1930, p. 4 (Sacapulas, Guatemala).

Marajuma, 3 ♂ ♂ and 1 ♀, Feb. 23, 1935 (De Schauensee).

These birds are clearly much paler both above and below than the rest of the Guatemalan series. Mr. Griscom saw but two specimens (Progreso, 1 ♀, 1 juv.) from the Motagua Valley and listed them under *P. s. guatemalensis*. The Marajuma series came from a much more arid region than Progreso. While we have not compared these skins with authentic specimens of *pallidus*, they seem to be that form.

**Myiarchus crinitus** (Linnaeus).

*Turdus crinitus* Linnaeus, Syst. Nat. I, 1758, p. 170 (Carolina).

Gualan and Quirigua, 2 ♂ ♂ and 1 ♀, Feb. 12 to 29, 1915 (Rhoads and Poole).

**Myiarchus cinerascens cinerascens** (Lawrence).

*Tyrannula cinerascens* Lawrence, Ann. Lyc. Nat. Hist. N. Y., V, 1852, p. 121 (western Texas).

Gualan, 1 ♂, Feb. 12, 1915 (Rhoads and Poole).

**Myiarchus tyrannulus nelsoni** Ridgway.

*Myiarchus magister nelsoni* Ridgway, Birds N. and Mid. Amer., pt. IV, 1907, p. 903 (Alta Mira, Tamaulipas, Mexico).

Quirigua and Gualan, 5 ♂ ♂, Feb. 16 to March 22, 1915 (Rhoads and Poole).

**Myiarchus nuttingi** Ridgway.

Proc. U. S. Nat. Mus., V, 1882, p. 395 (La Palma de Nicoya, Costa Rica).

Marajuma, 1 ♀, Feb. 23, 1935 (De Schauensee).

**Myiarchus tuberculifer lawrencei** (Giraud).

*Muscicapa lawrencei* Giraud, Sixteen New Species Texas Birds, 1841, p. 9 (Texas).

Volcan de Acatenango, 2 ♂ ♂, 1 ♀, Feb. 7, 11, 1935 (De Schauensee).

**Myiarchus tuberculifer connectens** Miller and Griscom.

Amer. Mus. Novit., No. 159, 1925, p. 6 (Las Cañas, Matagalpa, Nicaragua).

Gualan, 2 ♂ ♂ and 1 ♀, Feb. 22 to 24; Quirigua, 1 ♀, March 6, 1915 (Rhoads and Poole); Moca (3,500 feet), 1 ♀, March 8, 1935 (De Schauensee).

**Myiochanes cinereus brachytarsus** (Sclater).

*Empidonax brachytarsus* Sclater, Ibis, 1859, p. 441 (Cordoba, Vera Cruz, Mexico).

Quirigua, 2 ♂♂, March 25, 1915 (Rhoads and Poole); above Escuintla (2,500 feet), 1 indet., Feb. 8 and El Zapote, 1 ♀, Feb. 10, 1935 (De Schauensee).

The bird from El Zapote is very olivaceous on the mantle and with the pileum very blackish; throat and abdomen pale sulphur (quite conspicuous), and with the bill small and mandible very yellow. Wing 69 mm.

**Myiochanes pertinax pertinax** (Cabanis and Heine).

*Contopus pertinax* Cabanis and Heine, Mus. Hein., II, 1859, p. 72 (Jalapa, Vera Cruz, Mexico).

Guatemala City, 3 ♂♂, 2 ♀♀ and 1 indet., March 12 to 14, 1935.

**Empidonax flaviventris** (Baird).

*Tyrannula flaviventris* Baird, Proc. Acad. Nat. Sci. Phila., I, 1843, p. 283 (Carlisle, Pennsylvania).

Quirigua, 1 ♂ and 1 ♀, April 1, 2, 1915 (Rhoads and Poole).

**Empidonax traillii traillii** (Audubon).

*Muscicapa traillii* Audubon, Birds Amer., I, 1828, pl. XLV (Arkansas).

Quirigua, Gualan and Lake Amatitlan, 2 ♂♂ and 4 ♀♀, Feb. 6 to March 25, 1915 (Rhoads and Poole).

**Empidonax minimus** (Baird).

*Tyrannula minima* Baird, Proc. Acad. Nat. Sci. Phila., I, 1843, p. 284 (Carlisle, Pennsylvania).

Marajuma, San Cristobal, Coban, Patulul and Tecpam, Feb. 19 to March 7, 1935. From 1000 to 7,200 feet altitude (De Schauensee).

**Empidonax hammondi** (Xantus).

*Tyrannula hammondi* Xantus, Proc. Acad. Nat. Sci. Phila., X, 1858, p. 117 (Fort Tejon, southern California).

1 ♂ and 2 ♀♀ from Sta. Elena and Volcan de Acatenango, Feb. 11 to 28 (6,000 to 8,500 feet) (De Schauensee).

**Empidonax affinis**<sup>4</sup> **trepidus** Nelson.

*Empidonax trepidus* Nelson, Auk, 1901, p. 47 (Hacienda Chancol, Guatemala).

Santa Elena, 1 ♂, Feb. 28, 1935 (De Schauensee).

**Mitrephanes phaeocercus phaeocercus** (Sclater).

*Mitrephorus phaeocercus* Sclater, P.Z.S., 1859, p. 44 (Cordoba, Mexico).

Coban, 1 indet.; San Cristobal, 2 ♂♂, Feb. 19 to 21, 1935 (De Schauensee).

In Mr. Griscom's report on the birds of Guatemala he gives this race of *phaeocercus* as occurring in the highlands of Vera Paz on the strength of two old trade skins in the American Museum of Natural History. In a

<sup>4</sup> See Van Rossem., Bull. Mus. Comp. Zoöl., LXXVII, Nq. 7, p. 392, 1934.



later paper (Ibis, July, 1935, p. 550) he states that "specimens from Alta Vera Paz show that typical *phaeocercus* does not occur in Guatemala." We cannot agree to this later statement, because we have the three skins listed above which certainly are the typical form, being decidedly different from Honduras skins of *quercinus* in the Academy collection. (See remarks under *M. p. pallidus*, subsp. nov.).

***Mitrephanes phaeocercus pallidus*, subsp. nov.**

Type, ♂ adult, from Guatemala City, Guatemala, 5,000 feet. No. 121441, A.N.S.P., collected March 12, 1935, by Rodolphe M. de Schauensee.

**Diagnosis:** Similar in size to *M. p. phaeocercus* and *quercinus*, but much paler than *phaeocercus*, and with the upper parts without any olivaceous tinge whatever, a little paler than Saccardo's Umber. The lores are white, the feathers slightly tipped with pale Cinnamon; whole pileum and nape about Sepia, sharply defined from the mantle; rump a little paler and more cinnamonaceous; the wing bands are paler, that of the median coverts being buffy cinnamon and that of the greater series pale cream color; the under parts are very uniform in color, about Cinnamon Buff across the breast, with the throat and lower abdomen slightly paler; under wing coverts and axillars also paler cinnamon. The outer web of the outer rectrix is creamy white for almost the entire length (absent in both *phaeocercus* and *quercinus*) and the whitish edgings and tips on the secondaries wider. Length of wing 62 mm.; tail, 55 mm. Bill black, with the mandible yellow.

**Remarks:** These three skins of *pallidus* have been compared with three skins of *phaeocercus* from Coban and San Cristobal, Guatemala, and with three skins of *quercinus* from Juancito, Honduras.

The three skins of *phaeocercus* were compared with two Guatemalan skins in the U. S. National Museum, which had been pronounced by Salvin as being identical with the type, and were found to be the same.

Just what the range of this new race will prove to be is rather problematical, but it seems more than likely that it might be the subtropical zone of the eastern slopes of the mountains, while *phaeocercus* occupies the western slopes of the central and northern section of the country and *quercinus* the southwest.

***Terenotriccus erythrurus fulvularis* (Salvin and Godman).**

*Myiobius fulvularis* Selater and Salvin, Biol. Cent. Amer., II, 1889, p. 58 (Santa Fé, Veraguas).

Quirigua, 1 ♂, March 23, 1915. This bird agrees exactly with a skin from Honduras and they differ from Costa Rica and Panama birds in the brighter, more ochraceous front and less grayish mantle. A typical skin of *fulvularis* from Buenos Aires, Costa Rica, is exactly intermediate between Colombian birds and those from Honduras and Guatemala, those from Colombia having the mantle grayer and the front less ochraceous.

***Myiobius sulphureipygius sulphureipygius* (Selater).**

*Tyrannula sulphureipygia* Selater, P.Z.S., 1856, p. 296 (Cordova, Vera Cruz, Mexico).

Yzabal, 1 ♂, 1935 (De Schauensee).

**Tolmomyias sulphureus cinereiceps** (Sclater).

*Cychlorhynchus cinereiceps* Sclater, Ibis, 1859, p. 443 (Oaxaca, Mexico).

Gualan, 2 ♂ ♂, 1 ♀ and 1 indet., Feb. 9 to 26, 1915 (Rhoads and Poole).

**Todirostrum cinereum finitimum** Bangs.

Proc. Biol. Soc. Wash., XVII, 1901, p. 114 (San Juan Bautista, Tabasco, Mexico).

Quirigua, 1 ♂, March 19, 1915 (Rhoads and Poole); Yzabal, 1 indet., 1935 (De Schauensee).

**Todirostrum sylvia schistaceiceps** Sclater.

*Todirostrum schistaceiceps* Sclater, Ibis, 1859, p. 444 (Oaxaca, Mexico).

Quirigua, 2 ♂ ♂, March 9 and April 1, 1915 (Rhoads and Poole).

**Oncostoma cinereigulare** Sclater.

P.Z.S., 1856, p. 295 (Cordoba, Vera Cruz, Mexico).

Quirigua, 3 ♀ ♀, March 12, 13 and April 1, 1915 (Rhoads and Poole).

**Elainea flavogaster subpagana** Sclater and Salvin.

*Elainea subpagana* Sclater and Salvin, Ibis, 1860, p. 36 (Dueñas, Guatemala).

Gualan 1 ♂, Feb. 13, 1915 (Rhoads and Poole).

**Elainea viridicata placens** Sclater.

*Elainea placens* Sclater, P.Z.S., 1859, p. 46 (Cordoba, Vera Cruz, Mexico).

Quirigua, 1 ♂, March 29, 1915 (Rhoads and Poole).

**Tyranniscus vilissimus vilissimus** (Sclater and Salvin).

*Elainea vilissima* Sclater and Salvin, Ibis, 1859, p. 122 (Coban, Vera Paz, Guatemala).

Moca, 1 ♂, March 8, 1935 (De Schauensee).

**Pipramorpha oleaginea assimilis** (Sclater).

*Mionectes assimilis* Sclater, P.Z.S., 1859, p. 46 (Cordoba, Vera Cruz, Mexico).

Quirigua, 1 ♂, March 6, 1915 (Rhoads and Poole); Yzabal, 3 skins, 1935 (De Schauensee).

**Family PIPRIDAE****Manacus candei** (Parzudaki).

*Pipra candei* Parzudaki, Rev. Zool., 1841, p. 306 (Truxillo, Honduras).

Quirigua, 2 ♂ ♂, March 29 and April 2, 1915 (Rhoads and Poole); Yzabal, 1 ♂, 1935 (De Schauensee).

**Schiffornis turdinus verae-pacis** (Sclater and Salvin).

*Heteropelma verae-pacis* Sclater and Salvin, P.Z.S., 1860, p. 300 (Choctum, Vera Paz, Guatemala).

Yzabal, 1 skin 1935 (De Schauensee).

## Family COTINGIDAE

**Cotinga amabilis** Gould.

*Cotinga amabilis* Gould, P.Z.S., 1857, p. 64 (Guatemala).

Gualan, 1 ♂, Feb. 12, 1915 (Rhoads and Poole).

**Attila spadiceus flammulatus** Lafresnaye.

*Attila flammulatus* Lafresnaye, Rev. Zool., 1848, p. 47 ("Colombia"—Vera Cruz, Mexico, substituted by Bangs and Penard).

Quirigua, 1 ♂, March 5, 1915 (Rhoads and Poole).

**Rhytipterna holerythra holerythra** (Sclater and Salvin).

*Lipaugus holerythrus* Slater and Salvin, P.Z.S., 1860, p. 300 (Choctum, Vera Paz, Guatemala).

Quirigua, 1 ♂, March 3, 1915 (Rhoads and Poole); Yzabal, 1 skin, 1935 (De Schauensee).

**Platypsaris aglaiae sumichrasti** Nelson.

*Platypsaris aglaiae sumichrasti* Nelson, Auk, 1897, p. 52 (Otatitlan, Vera Cruz, Mexico).

Coban, 2 ♂ ♂, Feb. 21, 1935 (De Schauensee).

**Platypsaris aglaiae yucatanensis** Ridgway.

Proc. Biol. Soc. Wash., 19, 1906, p. 120 (Yucatan).

Gualan, 4 ♂ ♂, 2 ♀ ♀ and 1 ♂ juv., Feb. 19 to 22, 1915 (Rhoads and Poole); Marajuma, 1 ♂ and 1 ♀, Feb. 23, 1935 (De Schauensee).

These males are exactly like two skins from Yucatan and are very different from *sumichrasti*. They have also been compared with 4 ♂ ♂ (two topotypes) of *aglaiae*; 3 ♂ ♂ and 1 ♀ of *sumichrasti*, and 2 ♂ ♂ of *hypophaeus* of Honduras.

This is a new record for Guatemala. Mr. Griscom had seen no skins from the Motagua Valley. This is another case parallel to that of *Geococcyx velox pallidus*, where the arid Motagua Valley race is the same as that of Yucatan. Mr. Griscom lists *P. a. hypophaeus* from Guatemala on the strength of its occurrence in northern Honduras. It is possible that it may extend northward into the humid portion of the lower Motagua Valley, but no skins are available from that region. Certainly the upper Motagua Valley birds are typical *yucatanensis*.

**Tityra semifasciata personata** Jardine and Selby.

*Tityra personata* Jardine and Selby, Illustr. Orn., I, 1827, pl. XXIV (Real del Monte, Mexico).

Gualan, 4 ♂ ♂ and 2 ♀ ♀, Feb. 15 to 25, 1915 (Rhoads and Poole); Marajuma, 2 ♂ ♂, February 23; Moca, 1 ♂, March 8, 1935 (De Schauensee).

It might be supposed that the Motagua Valley birds would approach *T. s. desus* Bangs, of Yucatan, following the analogy of *Platypsaris aglaiae*,

but apparently they do not, being darker above than birds from western Guatemala, while they vary in the shade of the under parts from pale gray to almost white.

Family **HIRUNDINIDAE**

**Riparia riparia riparia** (Linnaeus).

*Hirundo riparia* Linnaeus, Syst. Nat., I, 1758, p. 192 (Sweden).

Quirigua, 1 ♀, March 23, 1915 (Rhoads and Poole).

**Iridoprocne bicolor** (Vieillot).

*Hirundo bicolor* Vieillot, Ois. Amer. Sept., I, 1807, p. 61 (east U. S.).

Quirigua, 1 ♂ and 2 ♀ ♀, March 23, 1915 (Rhoads and Poole).

**Iridoprocne albilinea** (Lawrence).

*Petrochelidon albilinea* Lawrence, Ann. Lyc. Nat. Hist. N. Y., VIII, 1863, p. 2 (Panama).

Quirigua, 1 ♂, March 23, 1915 (Rhoads and Poole).

**Tachycineta thalassina lepida** Mearns.

*Tachycineta lepida* Mearns, Proc. Biol. Soc. Wash., XV, 1902, p. 31 (Laguna Mts., San Diego Co., California).

Quirigua, 1 ♂, March 22, 1915 (Rhoads and Poole).

**Progne subis subis** (Linnaeus).

*Hirundo subis* Linnaeus, Syst. Nat., ed. 10, I, 1758, p. 192 (Hudson Bay).

Quirigua, 3 ♂ ♂ and 4 ♀ ♀, March 23, 1915 (Rhoads and Poole).

This species has been omitted by Mr. Griscom from his report on the birds of Guatemala, whether inadvertently or not, we do not know.

**Progne subis cryptoleuca** Baird.

*Progne cryptoleuca* Baird, Review Am. Birds, 1865, p. 277 (Remedios, Cuba).

Quirigua, 1 ♂ and 2 ♀ ♀, March 23 to 25; Gualan, 1 ♀, Feb. 25, 1915 (Rhoads and Poole).

These birds have been compared with authentic skins of *cryptoleuca* from Cuba and agree with them in every particular. The winter range of this species was unknown, it never having been taken outside of Cuba, excepting one record from Jamaica.

**Notochelidon pileata** (Gould).

*Atticora pileata* Gould, P.Z.S., 1858, p. 355 (Guatemala).

Near Guatemala City, 1 ♂ and 1 ♀, March 2, 1935 (De Schauensee).

Many were seen flying over a stream at the bottom of a ravine in company with the following species.

**Stelgidopteryx ruficollis serripennis** (Audubon).

*Hirundo serripennis* Audubon, Orn. Biog., IV, 1838, p. 593 (Charleston, S. C.).

Quirigua, 2 ♀ ♀ and 1 ♂, March 23, 24, 1915 (Rhoads and Poole); near Guatemala City, 1 ♀, March 2, 1935 (De Schauensee).

## Family SYLVIIDAE

**Polioptila caerulea deppei** Van Rossem.

Bull. Mus. Comp. Zool., LXXVII, No. 7, p. 402, 1934 (Rio Lagartos, Yucatan.)

Van Rossem has shown that the type of *P. c. mexicana* is a female of *P. c. caerulea* in winter plumage, and renames the small Mexican form.

Gualan, 2 ♀ ♀, Feb. 15 and 26, 1915 (Rhoads and Poole).

**Polioptila caerulea caerulea** (Linnaeus).

*Motacilla caerulea* Linnaeus, Syst. Nat., I, 1766, p. 337 (Philadelphia, Pa.).

Below Alotenango (4,000 feet), 1 ♀, Feb. 8, 1935 (De Schauensee).

**Polioptila bilineata albiloris** Sclater and Salvin.

*Polioptila albiloris* Sclater and Salvin, P.Z.S., 1860, p. 298 (Motagua Valley, Guatemala).

Gualan and Zacapa, 2 ♂ ♂ and 3 indet., Feb. 15 to 26, 1915 (Rhoads and Poole); El Rancho, 1 ♂, Feb. 17; Marajuma, 1 ♀, Feb. 23, 1935 (De Schauensee).

## Family TROGLODYTIDAE

**Heleodytes capistratus nigricaudatus** Nelson.

*Heleodytes capistratus nigricaudatus* Nelson, Auk, 1897, p. 70 (San Benito, Chiapas, Mexico).

Below Alotenango (4,000 feet), 1 ♂, Feb. 9, 1935 (De Schauensee).

**Heleodytes capistratus xerophilus** Griscom.

Amer. Mus. Novit., No. 414, 1930, p. 7 (Progreso, Guatemala).

Gualan and Zacapa, 2 ♂ ♂, 3 ♀ ♀ and 1 indet., Feb. 9 to 27, 1915 (Rhoads and Poole); El Rancho, 1 ♂ and 1 ♀, Feb. 17, 1935 (De Schauensee).

**Heleodytes zonatus zonatus** (Lesson).

*Picciaptes zonatus* Lesson, Cent. Zool., 1831, p. 210 ("California").

Antigua, Volcan de Acatenango and San Cristobal (3,500 to 6,000 feet), 2 ♂ ♂ and 2 ♀ ♀ (De Schauensee).

Griscom has noted a trade skin from Coban which he refers to *restrictus*, but the San Cristobal bird (noted above) comes from within a few miles of Coban, and is, without question, referable to *zonatus*. It is a trifle darker rufous on the abdomen and has a few scattered, small spots of black on the flanks, thus showing a slight tendency towards the lowland form, but is much nearer to the rest of the highland series (*zonatus*).

**Heleodytes zonatus restrictus** Nelson.

Auk, 1901, p. 49 (Frontera, Tabasco, Mexico).

Quirigua, 1 ♂ and 2 ♀ ♀, March 6 and April 2, 1915 (Rhoads and Poole).

The three skins listed above were compared by Dr. Friedman with a topotypical series of *restrictus* and with the five skins from Gavilan, Peten, noted by Van Tyne as being *restrictus*, but not typical (Univ. Mich. Misc. Papers, No. 27, p. 35, 1935), who says as follows:

"The birds from Gavilan, Peten are considerably smaller than either *restrictus* or *zonatus*. In color they are nearer to *zonatus*, but have some small black spots on the brownish abdomen. The spots, however, are neither as large or as numerous as in *restrictus*. The brownish color of the abdomen is fairly light and bright as in *zonatus*, not dull and dusky as in *restrictus*. The wing dimensions of these Gavilan birds are as follows: male, 78,78,83; female, 73 mm. The wings of eight topotypical *restrictus* are as follows: male, 91 (type), 89,88,85; female, 84,86,88,89 mm.

"The three birds from Quirigua are *restrictus*, but are less marked with blackish on the abdomen than are the topotypes of that form, but I doubt if any useful purpose would be served in attempting to separate them, especially since your number 64230 is quite heavily so marked. The other two might well be considered questionable.

"In other words, I think that your birds are to be referred to *restrictus* and not to *zonatus*. Van Tyne's Peten birds may form an undescribed racial group characterized by small size and the pale color of *zonatus* with the abdominal spotting of *restrictus*."

**Thryophilus pleurostictus pleurostictus** (Sclater and Salvin).

*Thryothorus pleurostictus* Sclater and Salvin, Ibis, 1860, p. 30 (Guatemala ex Skinner; Gualan designated by Griscom).

Gualan, 3 ♂ ♂ and 4 ♀ ♀, Feb. 10 to 26, 1915 (Rhoads and Poole); Yzabal, 1 ♂ and 1 ♀, 1935 (De Schauensee). Locality not positive.

**Thryophilus rufalbus rufalbus** (Lafresnaye).

*Thryothorus rufalbus* Lafresnaye, Rev. Zool., 1847, p. 337 (Mexico).

Quirigua, 1 ♂, March 19, 1915 (Rhoads and Poole).

**Thryophilus modestus pullus** Ridgway.

Proc. Biol. Soc. Wash., XVI, 1903, p. 167 (Huehuetan, Chiapas, Mexico).

Quirigua, 2 ♀ ♀, March 19 and April 2; Gualan, 1 ♂, Feb. 19, 1915 (Rhoads and Poole); Guatemala City, 2 indet., 1935 (De Schauensee).

**Pheugopedius maculipectus umbrinus** (Ridgway).

*Thryothorus maculipectus umbrinus* Ridgway, Man. N. Amer. Birds, 1887, p. 552 (Guatemala; Vera Paz designated by Griscom).

Quirigua, 2 ♂ ♂, 4 ♀ ♀ and 1 indet., March 9 to April 1, 1915 (Rhoads and Poole).

**Pheugopedius maculipectus varians** Griscom.

Proc. New Eng. Zool. Club, XII, 1930, p. 7 (San Jose, Guatemala).

Mocá, 1 ♂, March 9, 1935 (De Schauensee).

**Troglodytes musculus intermedius** Cabanis.

*Troglodytes intermedius* Cabanis, Jour. f. Orn., 1860, p. 407 (San José, Costa Rica).

Coban, 1 ♂, Feb. 21; Tecpam (7,200 feet), 1 ♂ and 1 indet., March 1, 3, 1935 (De Schauensee).

**Henicorhina leucosticta tropaea** Bangs and Peters.

Bull. Mus. Comp. Zool., LXVII, No. 15, 1927, p. 480 (La Vizagua, Costa Rica).

Quirigua, 4 ♂ ♂, 1 ♀ and 1 indet., March 6 to April 1, 1915 (Rhoads and Poole); Yzabal, 1 indet., 1935 (De Schauensee).

Family **MIMIDAE****Mimus gilvus gracilis** Cabanis.

*M(imus) gracilis* Cabanis, Mus. Hein., 1, January, 1851, p. 83, footnote (Honduras).

El Rancho, 1 ♂, Feb. 25, 1935 (De Schauensee).

Mr. Griscom has pointed out (Distribution of Bird Life in Guatemala, p. 300) that *M. g. lawrencei* Ridgway and *M. g. guatemalensis* Ridgway are identical, while Van Rossem (Bull. Mus. Comp. Zool., LXXVII, No. 7, p. 400, 1934) has shown that both of these names are synonyms of *M. gracilis* of Cabanis.

**Dumetella carolinensis** (Linnaeus).

*Muscicapa carolinensis* Linnaeus, Syst. Nat., I, 1776, p. 328 (Virginia).

Quirigua, 2 ♂ ♂ and 1 ♀, March 1 to 15, 1915 (Rhoads and Poole); Coban and San Cristobal, 2 ♀ ♀, Feb. 19, 1935 (De Schauensee).

**Melanotis hypoleucus** Hartlaub.

Rev. Zool., 1852, p. 460 (Guatemala).

San Cristobal, 1 ♂, Feb. 20; Guatemala City, 3 indet., 1935 (De Schauensee).

Family **TURDIDAE****Turdus grayi grayi** Bonaparte.

*Turdus grayi* Bonaparte, P.Z.S., 1837, p. 118 (Guatemala; Alta Vera Paz by subsequent designation).

Gualan and Zacapa, 4 ♀ ♀, Feb. 12 to 25, 1915 (Rhoads and Poole); San Cristobal, 1 ♂, Feb. 19; Marajuma, 1 ♀, Feb. 23, 1935 (De Schauensee). The San Cristobal bird is a topotype, that locality being in Alta Vera Paz.

**Turdus grayi umbrinus** Griscom.

Amer. Mus. Novit., No. 438, 1930, p. 3 (Finca El Cipres, near Mazatenango, Pacific slope, Guatemala).

Patulul (1,000 ft.); El Zapote (2,500 ft.); below Alotenango (4,000 ft.); Moca (3,100 ft.), 3 ♂ ♂ and 1 ♀, Feb. 8 to March 8, 1935 (De Schauensee); Quirigua, 1 ♂ and 1 ♀, March 3 and April 2, 1915 (Rhoads and Poole).

The two skins from Quirigua are identical in color with the four from the Pacific slope, but are slightly smaller ( $\delta$ , wing 120;  $\varphi$  117 mm.). There is also 1  $\delta$  from Lancetilla, Honduras (Caribbean slope) which is the same as the two Quirigua birds (wing, 115.5 mm.). Therefore, it seems that Mr. Griscom's restriction of *umbrinus* to the Pacific slope is erroneous. It apparently ranges over the Pacific slope up to not less than 4,000 feet, and over the humid lowlands of the Caribbean watershed. The slightly smaller size does not seem to be of sufficient value to separate these eastern birds from *umbrinus*, but it leaves the distribution of that race in a very peculiar situation.

***Turdus infuscatus* (Lafresnaye).**

*Merula infuscata* Lafresnaye, Rev. Zool., 1844, p. 41 (Mexico).

San Augustin, Acazaguastlan, 1  $\delta$ , 1935 (De Schauensee).

***Turdus ruftorques* Hartlaub.**

Rev. Zool., 1844, p. 214 (Guatemala).

Sta. Elena (8,500 feet), 2  $\delta$   $\delta$  and 3  $\varphi$   $\varphi$ , Feb. 28, 1935 (De Schauensee).

***Hylocichla mustelina* (Gmelin).**

*Turdus mustelinus* Gmelin, Syst. Nat., I, 1788, p. 817 (New York).

Quirigua, 1  $\delta$  and 1  $\varphi$ , March 27 and April 1, 1915 (Rhoads and Poole).

***Hylocichla ustulata ustulata* (Nuttall).**

*Turdus ustulatus* Nuttall, Man. Orn. U. S. and Canada, Land Birds, 1840, p. 830 (Columbia River).

Volcan de Acatenango, Antigua and Moca, 3  $\delta$   $\delta$  and 1  $\varphi$ , Feb. 12 and March 8, 1935 (De Schauensee).

***Catharus dryas dryas* (Gould).**

*Malacocichla dryas* Gould, P.Z.S., 1854, p. 285 (Guatemala).

Guatemala, 2  $\delta$   $\delta$  (?), 1935 (De Schauensee).

***Sialia sialis guatemalae* Ridgway.**

Proc. U. S. Nat. Mus., V, 1882, p. 13 (Guatemala).

Coban, 1  $\delta$ , Feb. 18 and Tecpam, Feb. 27, 1935 (De Schauensee).

Family **VIREONIDAE**

***Vireo flavoviridis flavoviridis* (Cassin).**

*Vireosylva flavoviridis* Cassin, Proc. Acad. Nat. Sci. Phila., V, 1851, p. 152 (Panama).

Guatemala City, 1 indet., 1935 (De Schauensee).

***Vireo gilvus swainsoni* Baird.**

*Vireo swainsoni* Baird, Reports of Explorations and Surveys for R.R. from Miss. River to Pacific Ocean, IX, 1858, p. 336 (Petaluma, Sonoma Co., California).

Below Alotenango and El Zapote, 2  $\varphi$   $\varphi$ , Feb. 8 and 10, 1935 (De Schauensee).



**Vireo flavifrons** Vieillot.

Ois. Amer. Sept., I, 1807, p. 85 (United States).

Gualan, 2 ♀ ♀ and 2 indet.; Quirigua, 1 ♂, Feb. 11 to March 22, 1915 (Rhoads and Poole); Moca, 1 ♂, March 6, 1935 (De Schauensee).

**Vireo solitarius solitarius** (Wilson).

*Muscicapa solitaria* Wilson, Amer. Orn., II, 1810, p. 143 (near Philadelphia).

Zacapa and Gualan, 2 indet., Feb. 11 to March 22, 1915 (Rhoads and Poole); Volcan de Acatenango and Coban, 2 ♂ ♂ and 1 ♀, Feb. 11 to 21, 1935 (De Schauensee).

**Vireo belli belli** Audubon.

*Vireo Bellii* Audubon, Birds Amer., VII, 1844, p. 333 (Fort Union, Dakota).

Gualan, 1 ♀, Feb. 11, 1915 (Rhoads and Poole).

**Vireo huttoni vulcani** Griscom.

Amer. Mus. Novit., No. 438, 1930, p. 3 (Quetzaltenango, 8,500 feet, Guatemala).

Santa Elena (8,500 ft.), 1 ♂, Feb. 28, 1935 (De Schauensee).

**Hylophilus ochraceiceps ochraceiceps** Selater.

*Hylophilus ochraceiceps* Selater, P.Z.S., 1859, p. 375 (Playa Vicente, Oaxaca, Mexico).

Yzabal, 1 ♂ 1935 (De Schauensee).

Family **CYCLARHIDAE****Cyclarhis flaviventris nicaraguae** Miller and Griscom.

Amer. Mus. Novit., No. 183, 1925, p. 6 (Matagalpa, Nicaragua).

Guatemala City, 1 ♀ and 1 indet., March 12, 1935 (De Schauensee).

Family **PTILOGONATIDAE****Ptilogonys cinereus molybdophanes** Ridgway.

Man. N. Amer. Birds, 1887, p. 464 (Guatemala).

Chichoy (10,000 ft.), Santa Elena (8,500 ft.) and Coban (4,000 ft.), 3 ♂ ♂ and 1 ♀, Feb. 21 to March 1, 1935 (De Schauensee).

Family **COMPSOTHYLPIDAE****Mniotilta varia** (Linnaeus).

*Motacilla varia* Linnaeus, Syst. Nat., I, 1766, p. 333 (Santo Domingo).

Quirigua, 1 ♂, March 25, 1915 (Rhoads and Poole).

**Helmitheros vermivorus** (Gmelin).

*Motacilla vermivora* Gmelin, Syst. Nat., I, 1788, p. 951 (Pennsylvania).

Quirigua, 2 ♀ ♀, March 24 and April 2, 1915 (Rhoads and Poole).

**Vermivora peregrina** (Wilson).

*Sylvia peregrina* Wilson, Amer. Orn., IV, 1811, p. 83 (Cumberland River, Tennessee).

Gualan, 1 ♂, Feb. 13, 1915 (Rhoads and Poole); San Cristobal, 1 ♀, Feb. 19; Moca, 2 indet., March 8; Marajuma, 1 ♂, Feb. 20, 1935 (De Schauensee).

**Compsothlypis pitiayumi inornata** (Baird).

*Parula inornata* Baird, Rev. Amer. Birds, I, 1864, p. 169 (Choctum, Guatemala).

Quirigua, 1 ♂, April 1, 1915 (Rhoads and Poole).

**Dendroica aestiva aestiva** (Gmelin).

*Motacilla aestiva* Gmelin, Syst. Nat., I, 1789, p. 996 (Canada).

Quirigua and Gualan, 2 ♂ ♂, Feb. 12 and March 8, 1915 (Rhoads and Poole).

**Dendroica aestiva sonorana** Brewster.

Auk, 1888, p. 137 (Oposura, Sonora, Mexico).

Gualan, 2 ♂ ♂ and 2 ♀ ♀, Feb. 11 to 26, 1915 (Rhoads and Poole).

**Dendroica aestiva rubiginosa** (Pallas).

*Motacilla rubiginosa* Pallas, Zoogr. Rosso-Asiatica, I, 1826, p. 496 (Sitka, Alaska).

San Cristobal, 1 ♂, Feb. 20, 1935 (De Schauensee).

**Dendroica coronata coronata** (Linnaeus).

*Motacilla coronata* Linnaeus, Syst. Nat., 12th. ed., I, 1766, p. 33 (near Philadelphia, Pennsylvania).

Gualan, 2 ♀ ♀, Feb. 23 and 26, 1915 (Rhoads and Poole); San Cristobal, 1 ♂ and 1 ♀, Feb. 20, 1935 (De Schauensee).

**Dendroica auduboni nigrifrons** Brewster.

*Dendroica nigrifrons* Brewster, Auk, 1889, p. 94 (Pinos Altos, Chihuahua, Mexico).

Santa Elena (8,500 ft.), 1 ♂, Feb. 28, 1935 (De Schauensee).

**Dendroica magnolia** (Wilson).

*Sylvia magnolia* Wilson, Amer. Orn., III, 1811, p. 63 (eastern U. S.).

Gualan and Quirigua, 4 ♂ ♂ and 2 ♀ ♀, Feb. 9 to April 2, 1915 (Rhoads and Poole); Moca, 1 ♂, March 8, 1935 (De Schauensee).

**Dendroica pennsylvanica** (Linnaeus).

*Motacilla pennsylvanica* Linnaeus, Syst. Nat., I, 1766, p. 333 (near Philadelphia, Pennsylvania).

Quirigua, 1 ♂, March 7, 1915 (Rhoads and Poole).

**Dendroica graciae decora** Ridgway.

*Dendroica graciae* var. *decora* Ridgway, Amer. Nat., VII, 1873, p. 608 (Belize, Brit. Honduras).

Quirigua, 1 ♂ and 1 ♀, March 25 and 29, 1915 (Rhoads and Poole).

**Dendroica virens virens** (Gmelin).

*Motacilla virens* Gmelin, Syst. Nat., I, 1789, p. 985 (Philadelphia, Pa.).

Coban, San Cristobal and Moca, 4 ♂ ♂ and 4 ♀ ♀, Feb. 11 to March 6, 1935 (De Schauensee). This species was not taken anywhere in the

lowlands by either Rhoads and Poole or the junior author. All of the skins noted above were taken above 3,000 feet (also noted by Griscom). In the highlands they were one of the commonest birds.

**Dendroica occidentalis** (Townsend).

*Sylvia occidentalis* Townsend, Jour. Acad. Nat. Sci. Phila., VII, 1837, p. 190 (near Ft. Vancouver, Washington).

San Cristobal, 1 ♂, Feb. 21, 1935 (De Schauensee).

**Dendroica townsendi** (Townsend)

*Sylvia townsendi* Townsend, Jour. Acad. Nat. Sci. Phila., VII, 1837, p. 191 (near Ft. Vancouver, Washington).

Guatemala City, Antigua and Santa Elena (5,000 to 8,500 ft.), 2 ♂ ♂ and 2 ♀ ♀, Feb. 9 to March 13, 1935 (De Schauensee).

**Seiurus aurocapillus** (Linnaeus).

*Motacilla aurocapilla* Linnaeus, Syst. Nat., I, 1766, p. 334 (near Philadelphia, Pennsylvania).

Quirigua, 1 ♀, March 15, 1915 (Rhoads and Poole).

**Seiurus motacilla** (Vieillot).

*Turdus motacilla* Vieillot, Ois. Amer. Sept., II, 1807, p. 9 (Kentucky).

Gualan, 1 ♂, Feb. 17, 1915 (Rhoads and Poole).

**Seiurus noveboracensis noveboracensis** (Gmelin).

*Motacilla noveboracensis* Gmelin, Syst. Nat., I, 1789, p. 958 (Louisiana and New York).

Quirigua and Gualan, 2 ♂ ♂, Feb. 22 and March 6, 1915 (Rhoads and Poole).

**Oporornis formosus** (Wilson).

*Sylvia formosa* Wilson, Amer. Orn., III, 1811, p. 85 (Kentucky).

Quirigua, 1 ♀, March 27, 1915 (Rhoads and Poole).

**Oporornis tolmiei** (Townsend).

*Sylvia tolmiei* Townsend, Narr. Journ. Rocky Mts., 1839, p. 343 (Columbia River, near Ft. Vancouver, Washington).

Alotenango and Patulul, 1 ♂ and 1 ♀, Feb. 8 and March 7, 1935 (De Schauensee).

**Geothlypis trichas brachydactyla** (Swainson).

*Trichas brachydactylus* Swainson, Anim. in Menag., 1838, p. 295 (northern Provinces of the United States).

Quirigua and Gualan, 2 ♂ ♂, 1 ♀ and 1 indet., Feb. 25 to March 8, 1915 (Rhoads and Poole); Coban and Guatemala City, 2 ♂ ♂ and 1 ♀, Feb. 18 to March 14, 1935 (De Schauensee).

**Icteria virens virens** (Linnaeus).

*Turdus virens* Linnaeus, Syst. Nat., I, 1758, p. 171 (Carolina).

Quirigua and Gualan, 1 ♂, 2 ♀ ♀ and 1 indet., Feb. 19 to March 29, 1915 (Rhoads and Poole).

**Wilsonia citrina** (Boddaert).

*Muscicapa citrina* Boddaert, Tabl. Pl. Enl., 1783, p. 41 (Louisiana).

Quirigua, 2 ♂♂, March 10 and 11, 1915 (Rhoads and Poole).

**Wilsonia pusilla pusilla** (Wilson).

*Muscicapa pusilla* Wilson, Amer. Orn., III, 1811, p. 103 (southern States).

Quirigua, 1 ♂ and 1 ♀, March 3 and April 2, 1915 (Rhoads and Poole); Tecpam, Alotenango and Volcan de Acatenango, 3 ♂♂ and 1 ♀, Feb. 11 to March 28, 1935 (De Schauensee). Very common in the highlands.

**Wilsonia pusilla chryseola** Ridgway.

Birds of North and Mid. Amer., 1902, p. 714 (Red Bluff, California).

Moca, Volcan de Acatenango and Alotenango, 3 ♂♂, Feb. 8 to March 8, 1935 (De Schauensee).

**Setophaga ruticilla** (Linnaeus).

*Motacilla ruticilla* Linnaeus, Syst. Nat., I, 1758, p. 186 (Virginia).

Quirigua, 1 ♂, March 8, 1915 (Rhoads and Poole).

**Setophaga picta guatemalae** Sharpe.

*Setophaga picta* subspecies *guatemalae* Sharpe, Cat. Birds Brit. Mus., X, 1885, p. 417 (Guatemala).

Tecpam (7,200 ft.) and Santa Rosa, 2 ♂♂, Feb. 22 and March 2, 1935 (De Schauensee).

**Myioborus miniatus flammeus** (Kaup).

*Setophaga flammea* Kaup, P.Z.S., 1851, p. 50 (Guatemala; Alta Vera Paz designated by Griscom).

Coban, 3 ♂♂ and 1 ♀, Feb. 18 to 21, 1935 (De Schauensee).

**Myioborus miniatus intermedius** Hartlaub.

*Setophaga intermedia* Hartlaub, Rev. et Mag. Zool., 1852, p. 5 (Guatemala; Panajachel, western Guatemala, designated by Griscom).

Volcan de Acatenango and Moca, 2 ♂♂ and 1 ♀, Feb. 11 to March 9, 1935 (De Schauensee).

**Idiotes salvini** (Cherrie).

*Basileuterus salvini* Cherrie, Proc. U. S. Nat. Mus., XIV, 1891, p. 342 (Coban, Vera Paz, Guatemala).

Alotenango and Guatemala City, 2 ♂♂, Feb. 9 and March 14, 1935 (De Schauensee).

**Idiotes rufifrons rufifrons** (Swainson).

*Setophaga rufifrons* Swainson, Anim. in Menag., 1838, p. 294 (Mexico; Real Ariba, Vera Cruz designated by Todd).

Guatemala City, 1 ♂, March 14, 1935 (De Schauensee).

We follow Griscom in his treatment of this species. The bird listed above is certainly quite different from the two skins of *I. salvini*, which are entirely yellow below, while this bird has the median portion of the abdomen

whitish and flanks dark olivaceous, while the pileum is paler chestnut and the back more brownish olive.

**Ergaticus versicolor** (Salvin).

*Cardellina versicolor* Salvin, P.Z.S., 1863, p. 188 (Volcan de Fuego).

Chichoy and Santa Elena, 2 ♂♂ and 1 ♀, Feb. 28 and March 1, 1935 (De Schauensee).

Family **FRINGILLIDAE**

**Hedymeles ludovicianus** (Linnaeus).

*Loxia ludoviciana* Linnaeus, Syst. Nat., I, 1766, p. 306 (Louisiana).

Gualan, 1 ♂ and 1 ♀, Feb. 19 and 24, 1915 (Rhoads and Poole); Patulul, 1 ♀, March 7, 1935 (De Schauensee).

**Guiraca caerulea caerulea** (Linnaeus).

*Loxia caerulea* Linnaeus, Syst. Nat., I, 1758, p. 175 (Carolina).

Quirigua and Gualan, 2 ♂♂, Feb. 19 and 24, 1915 (Rhoads and Poole); El Rancho, Guatemala City and Acatenango, 1 ♂ and 2 ♀♀, Feb. 9 to March 12, 1935 (De Schauensee).

**Guiraca caerulea**, subsp.

Gualan, 2 ♂♂ and 3 ♀♀, Feb. 13 to 26, 1915 (Rhoads and Poole).

We have not been able to satisfactorily identify these birds.

**Cyanocompsa cyanooides concreta** (Du Bus).

*Cyanoloxia concreta* Du Bus, Bull. Acad. Roy. Brux., XXII, 1855, p. 150 (Mexico).

Quirigua, 4 ♂♂ and 1 ♀, March 3 to 23, 1915 (Rhoads and Poole).

**Oryzoborus funereus funereus** Selater.

*Oryzoborus funereus* Selater, P.Z.S., 1859, p. 378 (Suchapam, Oaxaca, Mexico).

Yzabal, 1 ♂, 1935 (De Schauensee).

**Sporophila morelleti morelleti** (Bonaparte).

*Spermophila morelleti* Bonaparte, Consp. Gen. Ave., I, 1850, p. 497 (Peten, Guatemala. Locality on type label, as per Van Rossem).

Quirigua, 4 ♂♂ and 2 ♀♀, March 3 to 22, 1915 (Rhoads and Poole); Yzabal, 1 ♂, 1935 (De Schauensee).

**Sporophila mutanda** Griscom.

*Sporophila morelleti mutanda* Griscom, Amer. Mus. Novit., No. 438, 1930, p. 7 (Hacienda California, near Ocos, Pacific slope, Guatemala).

Quirigua, 1 ♂ and 1 ♀, March 20, 23, 1915 (Rhoads and Poole); Moca, Guatemala City and above Amatitlan, 1 ♂ and 2 ♀♀, Feb. 9 to March 8, 1935 (De Schauensee).

Mr. Griscom has described this bird as a subspecies of *S. morelleti*, with which we cannot agree, according to the material before us. He has given its range as *only* western Guatemala, while we have a fully adult, well marked specimen from Quirigua, taken with *morelleti*, and another

from Guatemala City (on the divide). Mr. Griscom further states that the female is inseparable from that of *morelleti*, but we believe it may be distinguished by the larger, more swollen and darker colored bill. We have two females from Quirigua (presumably typical *morelleti*) which have the bill much smaller and decidedly brownish, paler below, while three other females (Quirigua, Moca and above Amatitlan) have a larger, blackish horn-colored bill. Two of these (Moca and Amatitlan) are from the Pacific slope, in the known range of *mutanda*, and have the bill exactly as the single female from Quirigua. Therefore it seems logical to suppose that *mutanda* must be either a distinct species or nothing at all but a color phase of *morelleti*, the latter supposition being quite contrary to our belief.

**Volatinia jacarini atronitens** Todd.

Proc. Biol. Soc. Wash., XXIII, 1920, p. 72 (Campeche, Mexico).

Quirigua and Gualan, 6 ♂♂ and 2 ♀♀, Feb. 24 to March 25, 1915 (Rhoads and Poole).

**Saltator atriceps atriceps** (Lesson).

*Tanagra* (*Saltator*) *atriceps* Lesson, Cent. Zool., 1830, p. 208 (Mexico).

Gualan, 2 ♂♂ and 3 ♀♀, Feb. 17 to 26, 1915 (Rhoads and Poole); Alotenango, 1 ♂, Feb. 9, 1935 (De Schauensee).

**Saltator magnus magnoides** Lafresnaye.

*Saltator magnoides* Lafresnaye, Rev. Zool., 1844, p. 41 (Mexico; error, southeastern Guatemala designated by Peters).

Quirigua, 1 ♂ and 2 ♀♀, March 5 to April 1, 1915 (Rhoads and Poole).

**Saltator grandis grandis** (Lichtenstein).

*Tanagra grandis* Lichtenstein, Preis-Verz. Mex. Vog., 1831, p. 2 (Mexico).

Gualan, 1 ♀, Feb. 11, 1915 (Rhoads and Poole).

**Saltator grandis hesperus** Griscom.

Amer. Mus. Novit., No. 438, 1930, p. 8 (San Jose, Guatemala).

El Zapote and Amatitlan, 1 ♂ and 1 ♀, Feb. 10 and March 2, 1935 (De Schauensee).

This is a poorly marked race, although in series it may be more obvious.

**Spinus notatus notatus** (Du Bus).

*Carduelis notatus* Du Bus, Bull. Acad. Roy. Belg., XIV, 1847, p. 106 (Mexico).

Antigua, 1 ♂, Feb. 13, 1935 (De Schauensee).

**Spinus psaltria croceus** Jouy.

Proc. U. S. Nat. Mus., XVI, 1894, p. 780 (Panama).

Panajachel, 1 ♀, Feb. 13; Guatemala City, 1 ♀, 1935 (De Schauensee).

**Aimophila ruficauda connectens** Griscom.

Amer. Mus. Novit., No. 438, p. 9, 1930 (Progreso, Guatemala).

Gualan 2 ♂♂, 2 ♀♀ and 2 ○○, Feb. 11 and 12, 1915 (Rhoads and Poole); El Rancho, 1 ♂, Feb. 17, 1935 (De Schauensee).

***Aimophila rufescens gigas* Griscom.**

Amer. Mus. Novit., No. 438, 1930, p. 9 (Nebaj, Quiché, Guatemala).

Guatemala City, 1 ♂, March 14, 1935 (De Schauensee).

***Aimophila botterii sartorii* Ridgway.**

*Aimophila sartorii* Ridgway, Auk, XV, 1898, p. 227 (Huatusco, near Mirador, Vera Cruz, Mexico).

Guatemala City, 1 ○, 1935 (De Schauensee).

This bird is slightly darker than four skins of *botterii* (with which it was compared), both above and below, and is probably referable to *sartorii*, although it may possibly be the same as the single bird which Mr. Griscom refers to from Antigua (Distribution of Bird Life in Guatemala, p. 362).

***Zonotrichia capensis septentrionalis* Griscom.**

Amer. Mus. Novit., No. 438, 1930, p. 12 (Chichicastenango, Guatemala).

Tecpam, 4 ♂♂, March 3, 1935 (De Schauensee).

***Melospiza lincolni lincolni* (Audubon).**

*Fringilla lincolni* Audubon, Orn. Biogr., II, 1834, p. 539 (Labrador).

Tecpam, 1 ♂, March 2, 1935 (De Schauensee); Quirigua, 1 ♀, March 15, 1915 (Rhoads and Poole).

***Passerina ciris ciris* (Linnaeus).**

*Emberiza ciris* Linnaeus, Syst. Nat., I, 1758, p. 179 (Carolina).

Gualan and Quirigua, 7 ♂♂ and 4 ♀♀, Feb. 10 to March 29, 1915 (Rhoads and Poole); Alotenango and Patulul, 2 ♂♂, March 7 and Feb. 10, 1935 (De Schauensee).

***Passerina cyanea* (Linnaeus).**

*Tanagra cyanea* Linnaeus, Syst. Nat., I, 1766, p. 315 (South Carolina).

Gualan and Quirigua, 7 ♂♂ and 5 ♀♀, Feb. 5 to March 29, 1915 (Rhoads and Poole); Antigua, Amatitlan and San Cristobal, 2 ♂♂ and 1 ♀, Feb. 14 to March 1, 1935 (De Schauensee).

A very common migrant at every locality visited.

***Passerina versicolor purpurascens* Griscom.**

Amer. Mus. Novit., No. 438, 1930, p. 12 (Progreso, Guatemala).

Gualan, 2 ♂♂, Feb. 17, 1915 (Rhoads and Poole).

***Pipilo maculatus repetens* Griscom.**

Amer. Mus. Novit., No. 438, 1930, p. 12 (Zanzon, western Guatemala).

Tecpam, 1 ♂, March 3, 1935 (De Schauensee).

***Melospiza biarcuatum* (Prévost).**

*Pyrgila biarcuatum* Prévost, Voy. Venus, Ois., 1846, Pl. vi (Guatemala).

Guatemala City, Amatitlan, 2 ♂♂ and 1 ♀, March 1 and 12, 1935 (De Schauensee).

**Arremonops striaticeps chloronotus** (Salvin).

*Embernagra chloronota* Salvin, P.Z.S., 1861, p. 202 (Choctum, Vera Paz, Guatemala).

Quirigua, 2 ♂ ♂, 1 ♀ and 3 ○ ○, March 10 to 19, 1915 (Rhoads and Poole); Yzabal, 1 ○, 1935 (De Schauensee).

**Arremonops aurantirostris saturatus** Cherrie.

Proc. U. S. Nat. Mus., XIV, 1891, p. 345 (Choctum, Vera Paz, Guatemala).

Quirigua, 4 ♀ ♀ and 1 ○, March 6 to 23, 1915 (Rhoads and Poole).

**Atlapetes gutturalis griseipectus** Dwight and Griscom.

Amer. Mus. Novit., No. 16, 1921, p. 3 (Quezaltenango, Guatemala).

Guatemala City, 3 ○ ○, 1935 (De Schauensee).

Family **COEREBIDAE****Diglossa baritula montana** Dearborn.

*Diglossa montana* Dearborn, Field Mus. Publ. 125, 1907, p. 125 (Sierra Santa Elena, 9500 feet, near Tecpam, Guatemala).

Chichoy (10,000 ft.), 1 ♂, March 1, 1935 (De Schauensee). This specimen is a topotype.

**Cyanerpes cyaneus cyaneus** (Linnaeus).

*Certhia cyanea* Linnaeus, Syst. Nat., I, 1766, p. 186.

Quirigua, 7 ♂ ♂, March 25 to 29, 1915 (Rhoads and Poole); Moca and Coban, 6 ♂ ♂ and 5 ♀ ♀, Feb. 18 to March 9, 1935 (De Schauensee).

The only two males from Moca which are in full plumage are a trifle darker blue (more purplish) both above and below than the Quirigua specimens.

Family **THRAUPIDAE****Tanagra elegantissima** (Bonaparte).

*Pipra elegantissima* Bonaparte, P.Z.S., 1837, p. 112 (Mexico).

Volcan de Acatenango (6,000 ft.), 2 ♂ ♂ and 2 ♀ ♀, Feb. 10, 11, 1935 (De Schauensee).

**Tanagra affinis** Lesson.

Rev. Zool., 1842, p. 175 (Realejo, Nicaragua).

Gualan, 5 ♂ ♂ and 1 ♀, Feb. 11 to 25, 1915 (Rhoads and Poole).

**Tanagra lauta lauta** Bangs and Penard.

Bull. Mus. Comp. Zool., XLIII, No. 2, 1919, p. 35 (new name for *Euphonia hirundinacea* Salvin and Godman).

Gualan, 1 ♀, Feb. 24, 1915 (Rhoads and Poole).

**Tangara larvata larvata** (Du Bus).

*Calliste larvata* Du Bus, Esquiss. Orn., 1845, Pl. IX (Tabasco, s.e. Mexico).

Quirigua, 1 ♂, March 25, 1915 (Rhoads and Poole).



**Thraupis cana diaconus** (Lesson).

*Tanagra diaconus* Lesson, Rev. Zool., 1842, p. 175 (Realejo, Nicaragua).

Quirigua, 3 ♂♂, March 13 to 20, 1915 (Rhoads and Poole).

**Thraupis abbas** (Lichtenstein).

*Tanagra abbas* Lichtenstein, Preis-Verz. Mex. Vog., 1831, p. 2 (Oaxaca, Mexico).

El Pilar and Quirigua, 2 ♂♂ and 2 ♀♀, March 13 to 20, 1915 (Rhoads and Poole); El Zapote, 1 ♂ and 1 ♀, Feb. 10; San Cristobal, 1 ♂, Feb. 19, 1935 (De Schauensee).

**Ramphocelus passerinii passerinii** Bonaparte.

*Ramphocelus passerinii* Bonaparte, Antologia, 1831, No. 130, p. 3 (Mexico).

Quirigua, 5 ♂♂ and 2 ♀♀, March 11 to April 2, 1915 (Rhoads and Poole).

**Piranga rubra rubra** (Linnaeus).

*Fringilla rubra* Linnaeus, Syst. Nat., I, 1758, p. 181 (Carolina).

Quirigua and Gualan, 6 ♂♂ and 3 ♀♀, Feb. 9 to March 29, 1915 (Rhoads and Poole); Volcan de Acatenango (6,000 ft.) and San Cristobal, 2 ♂♂, Feb. 11 to 20, 1935 (De Schauensee).

**Piranga ludoviciana** (Wilson).

*Tanagra ludoviciana* Wilson, Amer. Orn., III, 1811, p. 27 (Louisiana).

Patulul, Mocá, Alotenango, Antigua and Chichoy (800 to 10,000 ft.), 4 ♂♂ and 5 ♀♀, February and March, 1935 (De Schauensee).

**Piranga flava figlina** Salvin and Godman.

*Pyrranga figlina* Salvin and Godman, Biol. Cent. Amer., I, 1883, p. 293 (Manatee River, British Honduras).

Quirigua, 1 ♀, March 9, 1915 (Rhoads and Poole).

**Piranga leucoptera leucoptera** Trudeau.

*Pyrranga leucoptera* Trudeau, Jour. Acad. Nat. Sci. Phila., VII, 1839, p. 190 (Mexico).

Mocá, 1 ♂, March 6, 1935 (De Schauensee).

**Habia salvini salvini** (Berlepsch).

*Phoenicothera salvini* Berlepsch, Ibis, 1883, p. 487 (Guatemala.—Alta Vera Paz designated by Griscom).

Quirigua, 5 ♂♂ and 3 ♀♀, March 9 to 23, 1915 (Rhoads and Poole); Yzabal, 1 ♂ and 1 ♀, 1935 (De Schauensee).

We were at a loss to determine to which race these birds belonged and accordingly sent our whole series of Central American skins of *H. salvini* to Mr. Ludlow Griscom, with the hope that with the additional material in the Museum of Comparative Zoölogy he could clear up the matter for us, and we take pleasure in giving his comments on this material:

"*Habia salvini* is in need of thorough revision, but material for an adequate job is (as yet) non-existent in this country. The type of the species from "Guatemala" is in the Berlepsch collection at Frankfurt.

While I restricted the type locality to Vera Paz on the ground that the chances were 100 to 1 that the type is a Vera Paz trade skin, this must sometime be definitely settled by comparing the type with authentic specimens of the various subspecies which occur in Guatemala.

"At the time I wrote my 'Birds of Guatemala' my *littoralis* record from Los Amates was based on the two specimens collected by Dearborn, who stated that he had compared them with authentic specimens of *littoralis* and found them to be identical. Your series, however, from the same region is absolutely inseparable from what is passing as *salvini*. It will be apparent, therefore, that either Dearborn was mistaken when comparing his birds, or that there is no such thing as *littoralis*.

"The Yucatan race is very distinct from the last two (*discolor* and *salvini*), and the characters attributed to it are entirely correct. It was originally supposed to be confined to the tip of the Yucatan Peninsula, but it is now definitely settled that birds from northern Peten in Guatemala are *peninsularis*, as is also the series in this Museum collected by Peters at Camp Mengel, Quintana Roo, just west of the British Honduras line. My *rooensis* was based on a series from the coastal forests of southern Quintana Roo and Ambergris Cay, British Honduras. I have just examined in this connection a small series of birds from British Honduras. Birds from the Toledo district show a slight approach to *rooensis* but are very much nearer *salvini*. Specimens from slightly farther north, from the Manatee river, are about half way between *salvini* and *rooensis*, and specimens from the pine ridges of the Cayo district in the interior are apparently *rooensis*. My impression at the moment is that *rooensis* is an intermediate between straight *salvini* and *peninsularis*, in which the male is nearer *peninsularis* and the female is nearer to *salvini*. It is exceedingly doubtful whether it has enough of a range to be worth recognizing.

"One of the great difficulties in subspecific work in this group is the rapid post-mortem change in color in both sexes. In the male in old skins the reds are quite volatile, the distinction between pink and scarlet tones as regards the throat is rapidly lost, and the general brownness and grayness of the body coloration tends to be increased by the fading out of the reds. In females the usual brown foxing occurs."

**Lanio aurantius** Lafresnaye.

Rev. Zool., 1846, p. 204 ("Colombia").

Yzabal, 1 ♂ and 1 ♀, 1935 (De Schauensee).

#### Family **ICTERIDAE**

**Gymnostinops montezuma** (Lesson).

*Cacicus montezuma* Lesson, Cent. Zool., 1830, p. 33 (Mexico).

Quirigua, 3 ♂ ♂ and 2 ♀ ♀, March 4 to 10, 1915 (Rhoads and Poole).

**Amblycercus holosericeus holosericeus** (Lichtenstein).

*Sturnus holosericeus* Lichtenstein, Preis-Verz. Mex. Vog., 1831, p. 1 (Alvarado, Vera Cruz, Mexico).

Quirigua, 3 ♂♂, 1 ♀ and 1 ♂, March 9 to 19, 1915 (Rhoads and Poole).

**Psomocolax oryzivorus impacificus** Peters.

Proc. Biol. Soc. Wash., XLII, 1929, p. 123 (Pasa Nueva, Vera Cruz, Mexico).

Quirigua and Gualan, 2 ♂♂ and 1 ♀, Feb. 25 to March 18, 1915 (Rhoads and Poole).

**Tangavivus aeneus involucratus** Lesson.

*Tangavivus involucratus* Lesson, Rev. Zool., 1839, p. 41 (Mexico).

Quirigua and Gualan, 2 ♂♂, Feb. 26 and March 3, 1915 (Rhoads and Poole).

**Icterus galbula** (Linnaeus).

*Coracias galbula* Linnaeus, Syst. Nat., I, 1758, p. 108 (America).

Quirigua, 1 ♂, March 25, 1915 (Rhoads and Poole); Patulul, Escuintla, Mocá, Coban and Tecpam (800 to 7200 ft.) 4 ♂♂ and 2 ♀♀, Feb. 7 to March 8, 1935 (De Schauensee).

**Icterus spurius** (Linnaeus).

*Oriolus spurius* Linnaeus, Syst. Nat., I, 1766, p. 162 (Carolina).

Gualan and Quirigua, 6 ♂♂ and 1 ♀, Feb. 13 to March 23, 1915 (Rhoads and Poole); Patulul, 1 ♂, March 7, 1935 (De Schauensee).

**Icterus prothemelas** (Strickland).

*Xanthornis prothemelas* Strickland, Jardine's Contrib. Orn., 1850, p. 120 (Guatemala).

Quirigua, 2 ♂♂ and 4 ♀♀, March 16 to April 2, 1915 (Rhoads and Poole).

**Icterus wagleri wagleri** (Sclater).

*Icterus wagleri* Sclater, P.Z.S., 1857, p. 7 (Mexico).

San Cristobal and Amatitlan, 1 ♂ and 1 ♀, Feb. 19 and March 1, 1935 (De Schauensee).

**Icterus chrysater chrysater** (Lesson).

*Xanthornis chrysater* Lesson, Oeuvr. Compl. Buffon, VII, 1847, p. 332 (Mexico).

Coban and San Cristobal, 4 ♂♂ and 1 ♀, Feb. 19 and 20, 1935 (De Schauensee).

**Icterus gularis tamaulipensis** Ridgway.

Proc. Wash. Acad. Sci., III, Apr. 15, 1901, p. 152 (Alta Mira, Tamaulipas, Mexico).

Below Alotenango (4,000 ft.), 1 ♀, Feb. 9, 1935 (De Schauensee).

This bird is very richly colored, in fact more so than a female from Tampico. We have before us three specimens of *tamaulipensis*, one a topo-

typical ♂ from Alta Mira. This ♂ has the wing 119 mm. long, and two ♀ ♀ from Tampico have a wing measurement of 105 and 116 mm., respectively. Griscom gives the wing measurements for *tamaulipensis* as 112 to 114 mm.

*I. gularis troglodytes* Griscom, the type of which came from Retalhuleu (900 ft.), on the Pacific slope of Guatemala, is said to be larger than *tamaulipensis*, with the wing ranging between 116 and 121 mm., which is practically the same as the measurements of our specimens of *tamaulipensis*. The color differences mentioned by the author are no more than is ordinarily found in any species of this genus from a single locality. With these facts before us, we fail to see how the race *troglodytes* can be maintained.

***Icterus sclateri alticola*** Miller and Griscom.

Amer. Mus. Novit., No. 184, 1925, p. 4 (Progreso, Guatemala).

Marajuma, 4 ♂ ♂, Feb. 23, 1935 (De Schauensee).

***Icterus sclateri*** subsp.

Gualan, 1 ♂ and 2 ♀ ♀, Feb. 13 to March 3, 1915 (Rhoads and Poole).

As pointed out by Griscom, these Gualan birds are very small (wing 97, 98, 101 mm.), the male is, however, immature (wing 101 mm.). We do not have sufficient material to satisfactorily determine the status of these birds.

***Icterus pectoralis pectoralis*** (Wagler).

*Psarocolius pectoralis* Wagler, Isis, 1829, p. 755 (Mexico).

Gualan, 3 ♂ ♂ and 4 ♀ ♀, Feb. 9 to 23, 1915 (Rhoads and Poole); Escuintla and below Alotenango (2,500 to 4,000 ft.), 2 ♂ ♂, Feb. 8 and 9, 1935 (De Schauensee).

The two birds from the Pacific slope *should* be *I. p. anthonyi* Griscom, but we can discern no differences between them and the Gualan birds of sufficient importance to validate the race *anthonyi*. The wing measurement for the two Pacific slope birds is 97 and 104 mm., while the six ♂ ♂ from Gualan measure 104 to 106 mm. (average 105 mm. The color is indistinguishable.

***Dives dives*** (Lichtenstein),

*Icterus dives* Lichtenstein, Preis-Verz. Mex. Vog., 1830, p. 1 (Mexico).

Quirigua, 2 ♀ ♀ and 1 ♂, March 8 to 24, 1915 (Rhoads and Poole); Coban, 1 ♂ and 1 ♀, Feb. 19, 1935 (De Schauensee).

***Cassidix mexicanus mexicanus*** (Gmelin).

*Corvus mexicanus* Gmelin, Syst. Nat., I, Pt. 1, 1788, p. 375 (Mexico).

Quirigua, Gualan and Amatitlan, 2 ♂ ♂ and 3 ♀ ♀, Feb. 5 to March 15, 1915 (Rhoads and Poole).

Family **CORVIDAE****Calocitta formosa pompata** Bangs.

Proc. New Eng. Zool. Club, 1914, IV, p. 101 (Bolson, N.W. Costa Rica).

Gualan, 4 ♂ ♂ and 2 ♀ ♀, Feb. 9 to 26, 1915 (Rhoads and Poole); El Rancho, 3 ♂ ♂ and 1 ♀, Feb. 17 to 22, 1935 (De Schauensee).

**Calocitta formosa azurea** Nelson.

Auk, 1897, p. 55 (Huehuetan, Chiapas, Mexico).

Patulul and Moca, 2 ♂ ♂ and 1 ♀, March 6 and 7, 1935 (De Schauensee).

**Cyanocitta stellari ridgwayi** Miller and Griscom.

Amer. Mus. Novit., No. 184, 1925, p. 7 (Volcan de Fuego, Guatemala).

Above Antigua (6,000 ft.), Tecpam and Volcan de Fuego, 2 ♂ ♂ and 2 ♀ ♀, Feb. 7 to 28, 1935 (De Schauensee).

**Aphelocoma unicolor coelestis** Ridgway.

Birds of North and Mid. Amer., III, 1904, p. 345 (San Cristobal, Chiapas, Mexico).

St. Augustin, Acazaguastlan, 1 ♂, 1935 (De Schauensee).

**Xanthoura luxuosa centralis** Van Rossem.

Bull. Mus. Comp. Zool., LXXVII, No. 7, p. 397, 1934 (Secanquim, Guatemala).

Quirigua, 1 ♂, March 3, 1915 (Rhoads and Poole).

This race has previously been known as *X. l. guatemalensis*, but Mr. Van Rossem has pointed out that the name *guatemalensis* is applicable to the species *yncas* of South America, and the race known as *chloronotus*.

**Cissilopha melanocyanea melanocyanea** (Hartlaub).

*Garrulus (Cyanocoraz) melanocyaneus* Hartlaub, Rev. Zool., 1844, p. 215 (Guatemala).

Amatitlan, 1 ♀, Feb. 6, 1915 (Rhoads and Poole); Coban, Antigua and San Cristobal, 2 ♂ ♂ and 3 ♀ ♀, Feb. 9 to 20, 1935 (De Schauensee).

**Cyanolyca pumilo pumilo** (Strickland).

*Cyanocoraz pumilo* Strickland, in Jardine's Contrib. Orn., 1849, p. 122 (Guatemala).

Chichoy (10,000 ft.), 1 ♂, March 1, 1935 (De Schauensee).

**Psilorhinus mexicanus cyanogenys** Sharpe.

*Psilorhinus cyanogenys* Sharpe, Cat. Birds Brit. Mus., III, 1877, p. 140 (Pearl Bay Lagoon, east Nicaragua).

Quirigua and Gualan, 2 ♂ ♂ and 3 ♀ ♀, Feb. 17 to March 13, 1915 (Rhoads and Poole); Yzabal, 1 ♂ and 1 ♀, 1935 (De Schauensee).

## A STUDY OF THE GENUS *HEMIMERUS* (DERMAPTERA, HEMIMERINA, HEMIMERIDAE)

BY JAMES A. G. REHN AND JOHN W. H. REHN.

In 1871, Francis Walker gave to a strange, apterous and blind insect from Sierra Leone the name *Hemimerus talpoides*. He knew nothing of its habits and little concerning its relationship. The intervening years have given us vastly more information on this curious insect, which we now know to be an ectoparasite, occurring in all probability only on terrestrial giant rats of the genus *Cricetomys*, the hosts as well as parasites being limited in distribution to tropical Africa.

In the course of determinative work on certain series of African Dermaptera and Orthoptera the authors found it necessary to investigate rather fully the literature bearing on *Hemimerus*, and particularly the systematics of the genus. An unexpected opportunity for the senior author to visit Central Africa furnished the means for acquaintance with *Hemimerus* in nature, a privilege which most investigators of the subject have lacked. In consequence, the present study grew by accretion of information from its original small beginnings to a comprehensive study of the systematics and, to a degree at least, the bionomics of *Hemimerus*. In this we have been aided most cordially by colleagues in various institutions, to whose coöperation specific acknowledgment is made on a following page.

*Historical Summary.*<sup>1</sup> Walker, when presenting the original description of the genus *Hemimerus*, in 1871, placed it, without further comment, as a member of the Gryllidae. The five specimens he referred to the genotype *H. talpoides* were said by him to be males, but, as shown on a subsequent page under our discussion of that species, at least two of these original specimens were females. All were said to be from Sierra Leone, except one labelled solely "West Africa".

A single male of the Walkerian material passed into the hands of Saussure, who from its examination in 1879 erected the order Diploglossata to include *Hemimerus*, chiefly on the assumption that it possessed two distinct, superimposed labia, an error corrected by Hansen in 1894, and admitted by Saussure in 1896, faulty preparation having been responsible. The first illustrations of the genus and details of its features were presented in Saussure's earlier paper. Meinert in 1880 summed up the then existing

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<sup>1</sup> References to the specific papers here discussed are given on succeeding pages under the systematic treatment, or will be found in the bibliography at the end of this study.

knowledge of the structure of *Hemimerus* and concluded that it (Diploglossata) should stand between the Orthoptera and the Thysanura.

Aurivillius in 1890, when quoting Sjöstedt's previously unpublished statement, gave us the first actual report that *Hemimerus* is an ectoparasite living on a mammal, although no further information is given as to the exact host. Sharp, after seeing Aurivillius' paper, wrote in 1892 that he had previously examined *Hemimerus*, ventured it to be a parasite, and thought that it might be placed among the Coleoptera near the Platypyllidae.

The first fundamentally important study of *Hemimerus*, based on material other than the original Walkerian series, was brought out by Hansen in 1894. This memoir presented a careful study of the external features of the genus, illustrated by detailed and accurate figures, demonstrated the viviparity of the insect, which he considered to be an ally of the earwigs, and affirmed its ectoparasitic mode of life by quoting a portion of a letter from Sjöstedt, who while in the Cameroons, secured, from *Cricketomys*, the material forming the basis of Hansen's work. Hansen considered his material to be specifically identical with Walker's Sierra Leone specimens.

Sharp, the same year, when presenting a short revision of Hansen's memoir, stated that in his opinion the species examined by Hansen was distinct from *talpoides* Walker, and the following year (1895) he gave to the insect studied by Hansen the name *Hemimerus hanseni*. He also created the family Hemimeridae to include the genus, giving it equal rank in the orthopteroid stock to the Forficulidae, then used for all the earwigs.

Saussure, in 1896, after having had an opportunity to examine some of the material collected by Sjöstedt, corrected his erroneous erection of the order Diploglossata. In 1898 Cook, when reporting a specimen of the genus from Liberia, stated it was found under rotting wood. Bormans and Krauss, in their study of the earwigs and their allies for "Das Tierreich" (1900), gave this group as the family Hemimeridae, but evidently overlooked Sharp's name *Hemimerus hanseni*, as it was not mentioned. Poche, in 1902, in reviewing the literature on *Hemimerus* pointed out Bormans and Krauss' oversight. Verhoeff, in the same year, compared *Hemimerus* with the Dermaptera and the Blattidae, concluded that it occupies a position between the two and proposed for it the subordinal name Dermordermaptera.

Kirby in his "Synonymic Catalogue of the Orthoptera", which is dated 1904, gave *H. hanseni* as distinct from *talpoides*.

In 1905, Bouvier reported *H. talpoides* from Timbo, Fouta-Djalon and Basse Casamance, French Guinea, quoting from an interesting letter from Dr. Maclaud, a colonial official, who collected the specimens. Dr. Maclaud stated the parasites leave the *Cricketomys* very shortly after its death, and that according to the natives, who are acquainted with the insect, it occurs

on no other host. The same author in 1906 also reported, as *H. talpoides*, a specimen taken by Guillaume Vasse at Guengère, in the Pungwe Valley of Portuguese East Africa.

In 1906, Vosseler published the first of his two contributions on *Hemimerus* as occurring at Amani, Usambara Mountains, in the present Tanganyika Territory, and this author during the next few years furnished from his Amani Station, numerous specimens of the genus to Heymons for his important morphological, anatomical and embryological studies of the insect. Both Vosseler and Heymons considered the material before them to be *H. talpoides*.

Carpenter, in 1909, presented the first comparison of the diagnostic features of *H. talpoides* and *hanseni*, recording the latter species from Entebbe, Uganda. The same year Heymons published the first of the three important contributions made by him to our knowledge of *Hemimerus*. This first paper announced the occurrence of a placenta in the genus. Jordan in 1910, on the basis of material taken by the British Ruwenzori Expedition, said to be *talpoides*, discussed various features of the internal anatomy, and concluded that the internal genitalia demonstrated definite affinity with the earwigs. He<sup>2</sup> also gave us the only conclusions as to the probable food of these ectoparasites—"We have examined the gut of four specimens. The contents are the same in all four, which may possibly be explained by the specimens being perhaps obtained from the same individual of *Cricetomys*. The oesophagus and crop were filled with a whitish matter, and the same substance was found in the other divisions of the alimentary canal. In this mass is embedded everywhere a large number of variously shaped brown bodies, which prove to be the spores and sporangia of fungus. There is also some dark amorphous matter, which may have come into the alimentary canal accidentally with the food as dirt. I have examined the epidermis (and the foreign matter covering it) of the two stuffed specimens of *Cricetomys* contained in the Tring Museum. The specimens had been living in captivity in England for some time before they came into the collection. The scurf taken from these skins very much resembles the pale matter in the alimentary canal of *Hemimerus*, and I also found some brown spores of fungus. This result goes far to corroborate Vosseler's conclusion that *Hemimerus* feeds on the epidermis of the host. But the presence of the fungus suggests that the bare patches on the skin of *Cricetomys* are not caused by *Hemimerus*, but by a fungus, and that the parasite becomes beneficent to its host by eating the fungus as well as the scurf."

Burr, in 1911, in his treatment of the Dermaptera for the "Genera Insectorum" considered *Hemimerus* to represent a suborder of the Dermaptera,

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<sup>2</sup> Jordan. Novitates Zoologicae, xvi, p. 327, (1909).



for which he proposed the name *Hemimerina*, equal in rank to the *Arixenina* (genus *Arixenia*) and the *Forficulina* (embracing all the true earwigs).

In 1911 Heymons, from the basis of Amani material furnished by Vosseler, presented a preliminary study of the growth of individuals of the genus, followed the next year by his monographic study of the genitalia and development of *Hemimerus*. In these, as in his previous papers, Heymons considered his Amani material to represent *H. talpoides*. The 1912 study by Heymons constitutes our most important single contribution to the morphology and embryology of *Hemimerus*.

In 1915 Burr, in a comparative study of the male genitalia of the Dermaptera, briefly described the internal genitalia of the male of *Hemimerus* and pointed out the general agreement with the other dermapterous types. Schouteden in 1919 recorded material from the Ituri, Belgian Congo, taken from "*Cricetomys gambianus emini*," as *H. talpoides*. Gedge, in 1921, reported *H. hanseni* taken from a specifically unidentified *Cricetomys* at Nairobi, Kenya Colony. J. A. G. Rehn in 1924 reported material taken by Rodhain in the region of the Uele, Belgian Congo, as *H. hanseni*. In 1930, Bequaert recorded a single specimen from Burunga, Belgian Congo, as the same species.

In 1933, Hansen, in a discussion of the external organs of the Dermaptera, compared *Hemimerus* with the true earwigs and reaffirmed the position of that genus as a member of the Dermaptera.

In late 1934 and in 1935 Chopard brought out three contributions to our knowledge of *Hemimerus*, the results dealing very largely with the systematics of the genus, as well as illustrating and discussing the growth and development of the terminal plates of the abdomen in both sexes. In the first of these (December, 1934) two new species were described, one, *H. bouvieri*, on the basis of the single male from Guengère, Portuguese East Africa, previously reported as *talpoides* by Bouvier, the other, *H. chevalieri*, founded on one male and eight females taken in the Ivory Coast by A. Chevalier. The second study (December 29, 1934) reported material from Belgian Congo localities as *H. hanseni* and figures the female and records both sexes of *H. bouvieri* from three other Belgian Congo localities. The third of Chopard's contributions (June, 1935) summarized the published systematics of the genus, presented his conclusions on the relationship of the species, figured features of systematic importance, and recorded previously unreported material of *H. talpoides* from French Guinea, *H. chevalieri* from the Ivory Coast and *H. hanseni* from Mt. Elgon, Uganda-Kenya.

*Material Examined.* A total of 343 specimens have been examined in the course of the present study, of these 67 being adult males, 161 adult females, and 115 immature individuals of both sexes. Of this total 169

were preserved as dry specimens and 174 as alcoholic preparations. In certain cases both wet and dry preparations of the same lot of material were available. The extensive series of *H. hanseni* taken by the George Vanderbilt African Expedition of 1934 has been of great value, accompanied as it is by specimens of the host and capture notes made by the senior author, while the even larger representation of *H. deceptus* submitted by the Transvaal Museum has been of equally important service. In the following pages material belonging to various collections or institutions is indicated by abbreviations of their titles. Where no symbols are given the material belongs to the Academy of Natural Sciences of Philadelphia.

*Acknowledgments.* For the loan of material and other valuable coöperation we wish to thank Mr. B. P. Uvarov, of the British Museum of Natural History, Mr. A. N. Caudell, of the United States National Museum, Mr. Nathan Banks, of the Museum of Comparative Zoölogy, Mr. G. Van Son, of the Transvaal Museum, of Pretoria, Dr. A. D. Imms, of Cambridge University, Cambridge, England, and Dr. A. Avinoff and Mr. Hugo Kahl of the Carnegie Museum of Pittsburgh. Dr. Gerrit S. Miller, Jr., Curator of Mammals of the United States National Museum, and Dr. Glover M. Allen, Curator of Mammals of the Museum of Comparative Zoölogy, have kindly assisted by answering queries and otherwise supplying important information concerning the *Cricetomys* hosts of *Hemimerus*. Dr. Harold A. Coolidge and Mr. A. Loveridge, of the same museum, Mr. Edmund Heller, of the San Francisco Zoological Gardens, and Dr. Rudolph Bigalke, of the National Zoological Garden of South Africa, at Pretoria, have kindly assisted with information, chiefly concerning specimens taken by them or from host rats in the collections in their charge.

*Systematic Position.* The suborder *Hemimerina* is related more closely to the *Arizenina* and the *Forficulina* than to any other insects. It shows many resemblances to the *Arizenina*, particularly in the setose cerci, which, however, are much more heavily chitinized in the latter. Both of these suborders differ from the *Forficulina* by having the labial palpi greatly reduced, the mentum increased and the submentum decreased in size. While the mandibles are somewhat similar to those of the *Forficulina* they differ greatly from those of the *Arizenina*. The maxillae of *Hemimerus*, moreover are of a quite different type from those found in the other two suborders.

In the *Hemimerina* the eyes are completely absent and the optic nerve is reduced; in the *Arizenina* the eyes are reduced but not wanting, while in the *Forficulina* they are usually well developed.

The tergites of the thorax are more broadly expanded than in any of the related forms, but the rest of the thoracic structure shows definite affinities with that of the *Forficulina*.

The ultimate sternite of the male *Hemimerus*, being highly specialized and asymmetrically developed, does not show any close relationships with that of the other dermapteroid insects. The whole terminal abdominal area of both sexes does not show any marked resemblance to that type of development found in the true earwigs, but the genus, nevertheless, apparently has been evolved from the dermapteroid stock. The internal genitalia show a very definite relationship with those found in the other Dermaptera, being essentially of a Eudermapterous type, as understood by Burr.

The legs of *Hemimerus* show a definite resemblance with those found in the *Forficulina*, but they are extremely specialized for their unusual mode of life.

#### HEMIMERINA

*Diploglossata* (order) Saussure, Mém. Soc. Hist. Nat. Genève, XXVI, p. 412, (1879).—Meinert, Vidensk. Meddel. Nat.-hist. Foren. Kjøbenhavn, 1879-1880, p. 343, (1880).

*Dermodermaptera* Verhoeff, Sitz.-Berichte Gesellsch. Natur. Freunde Berlin, 1902, p. 89, (1902).

*Hemimerina* Burr, Genera Insectorum, fasc. 122, p. 8, (1911).—Burr, Journ. Royal Microsc. Soc., 1915, p. 421, (1915).—Rehn, Bull. Amer. Mus. Nat. Hist., XLIX, p. 351, (1924).

Apterous, eyes absent, viviparous, cursorial; head narrow cephalad, broad caudad; thoracic tergites laterally expanded; tibiae compressed, in outline expanded subtriangular, extensor surface of tibiae, in distal half, concavely excavate for reception of tarsi when flexed; distal portion of parameres asymmetrical, with one penis and two praeputial sacks; elongate cerci not segmented, nor modified into forceps; ectoparasitic on mammals.

#### HEMIMERIDAE

*Hemimeridae* Sharp, Cambr. Nat. Hist., V, p. 217, (1895).—Bormans and Krauss, Das Tierreich, Lief. 11, p. 130, (1900).—Poche, Zool. Anzeiger, XXV, p. 667, (1902).—Kirby, Syn. Cat. Orth., I, p. 59, (1904).—Burr, Genera Insectorum, fasc. 122, p. 8, (1911).—Rehn, Bull. Amer. Mus. Nat. Hist., XLIX, p. 351, (1924).

Characters the same as those of the suborder.

#### HEMIMERUS Walker

*Hemimerus* Walker, Cat. Derm. Salt. Brit. Mus., V, Suppl. p. 2, (1871).—Saussure, Mém. Soc. Hist. Nat. Genève, XXVI, p. 413, (1879).—Hansen, Ent. Tidskr., 1894, p. 66, (1894).—Saussure, Rev. Suisse, Zool., IV, p. 277, (1896).—Bormans and Krauss, Das Tierreich, Lief. 11, p. 132, (1900).—Kirby, Syn. Cat. Orth., I, p. 59, (1904).—Burr, Genera Insectorum, fasc. 122, p. 8, (1911).—Rehn, Bull. Amer. Mus. Nat. Hist., XLIX, p. 351, (1924).

Form oblong-ovate, greatest width at mesothorax. Body flattened, dorsal surface convex, ventral surface of abdomen convex, thoracic venter deplanate to slightly convex; surface with minute hairs. Cerci conspicuous, filiform, unsegmented.

Head flattened, directed forward, about twice as broad as long, distinctly narrower than thorax; general outline semicircular, occiput concave, sharply cut off from dorsal portion of head, dorso-occipital margin armed with

numerous short, heavy setae. Buccal appendages occupying cephalic portion of ventral surface, caudo-lateral portions of epicranium angularly produced. Eyes completely lacking. Antennae well developed and consisting of eleven segments (in adults). Mouthparts prominent; labrum occupying most of anterior margin of the head, being three times as broad as deep, cephalic margin rounded, curving under and forming a flap-like covering; mouthparts well developed and of chewing type.<sup>3</sup> Antennae with proximal joint subcylindrical, at least twice as long as succeeding joints; third and fourth segments quite short, subquadrate in outline, succeeding joints excepting the ultimate, rectangulate in outline, twice as long as broad; ultimate joint acuminate; all multisetose.

Three nota of thorax laterally expanded so as to form broad, slightly convex plates. Pronotum about twice as long as broad, largest of the three nota; caudal margin strongly concave so that caudo-lateral angles overlap the mesonotum. Mesonotum approximately one-fourth as long (medio-longitudinal) as wide, forming widest portion of body; caudal margin slightly concave, caudo-lateral angles slightly overlay the metanotum. Metanotum smallest of the three nota, slightly less than mesonotum in length and breadth; caudal margin more weakly concave than in preceding terga, and not appreciably overlaying the first abdominal tergite. The definite lateral extension of the three nota makes of the whole a shield-like covering. Sterna all relatively narrow, ventral surface deplanate or slightly convex;<sup>4</sup> prosternum longest and narrowest, cephalic margin slightly concave, lateral margins cephalad sub-parallel, caudal portion (intercoxal) concavely emarginate, caudal margin sub-truncate, caudal portion overlaying the cephalic portion of mesosternum; mesosternum shorter and broader, lacking inter-coxal emargination, caudal margin arcuate, overlaying the cephalic portion of the metasternum which is more strongly transverse, greater portion of lateral margins concave emarginate, caudal margin subtruncate.

Legs short, comparatively stout; femora short, stout and somewhat arched, tibiae compressed, in outline expanded subtriangular, extensor surface, in distal half, concavely excavate to receive the tarsi when flexed, this area margined by long, stout setae; tarsi three-jointed, first two short and heavy, third slender, elongate and apically armed with two equal claws.

Abdomen somewhat longer than head and thorax together; tergites broad, expanded, in cross-section extending mesad on ventral surface; sternites simple, extending almost the full width of venter; first segment shorter than remaining segments of abdomen. Females (adult) with nine visible tergites and six visible sternites; males (adult) with eleven visible tergites and eight visible sternites.

In the males and females the last two visible tergites are partially fused, forming a trapezoidal or subtriangular process. In the females the last evident sternite has a rounded median produced portion. In the males the ultimate sternite is produced into a digit-like process which is developed from the posterior, asymmetrical margin.

<sup>3</sup> For detailed description of mouthparts see Hensen, *Entomologisk Tidskrift*, 1894, pp. 67-71, (1894).

<sup>4</sup> The latter condition is probably due in most, if not all, cases to the drying of the specimens.

Cerci filiform, conspicuous, unsegmented, superficially segmented appearance due to the pits of numerous setae, not heavily chitinized nor modified into forceps, covered with numerous, rather heavy setae.

Parameres asymmetrical, sinistral strongly arcuate, dextral evenly and slightly curved.

The coloration is the same in all the species, uniform orange-ochraceous, paler ventrad. Live specimens shows the same coloration as wet or dry preserved individuals.

*Genotype* (by monotypy).—*Hemimerus talpoides* Walker.

*Generic Variation*.—The method of preparation of material is in large part responsible for the variation noted in all series of the genus. No variation, in adult material, has been found of sufficiently noteworthy importance, which has not been due to this factor. The evident variations which are due to methods of preservation are almost entirely of the proportions of parts. The proportionate length and length to breadth of articles of the antennae is more fully discussed under *H. hanseni*, and is there shown as doubtless due to the wet or dry condition of the material examined. The lateral expansions of the thoracic tergites show in their decurvature and apparent expansion, when seen from the dorsum, a direct concordance with that of the sternal plates of this region. This is undoubtedly due, in dry material, to twisting, buckling and pulling during dessication, and is especially evident in individuals originally collected as wet material. The proportions of the tarsal articles was used by Carpenter<sup>5</sup> as a specific diagnostic feature, but extensive examination of material has shown that there is in this respect some variation, but this is undoubtedly due to the method of preservation. Both the thorax and the abdomen may be extended or retracted to such an extent that the general ensemble is quite different. This again may be due to the method of preservation. The form of the terminal abdominal segments is basically specific in value, and such variation as has been noted is discussed under the individual species.

<sup>5</sup> Carpenter (Ent. Month. Mag., XLV, p. 254, (1909) gave a key to separate *hanseni* and *talpoides*. This study was the first to give any characters to separate the two species then known. We feel, however, that some of the differential characters used by him are not of specific value. The form of the sternal plates and the width of the abdomen, which he discussed, apparently vary according to the method of preparation. We find that specimens dried from alcohol, individuals which have never been in alcohol, wet material and that collected dry are not truly comparable, as the chitin is easily distorted, buckling and twisting with dehydration. When a reasonably large series is measured no constant difference is seen between *hanseni* and *talpoides* in the proportionate length of the terminal tarsal article, when compared with that of the basal article. Without knowledge of the method followed by Carpenter in measuring the length of the basal tarsal article, its peculiar shape presents several possible dimensions which might be considered the length of the article. However, Carpenter does recognize one of the fundamental differences between these two species, i.e. the shape of the ultimate tergite.

*Critique of Recent Systematic Literature.*—During the course of preparation of the present study there have appeared three contributions<sup>6</sup> by our colleague Dr. Lucien Chopard, in which two new species of the genus *Hemimerus* were described and material largely unrecorded previously, referred to these two, as well as to the previously known forms, i.e. *talpoides* and *hanseni*.

In the first of these papers<sup>6</sup> Dr. Chopard has described without figures *H. bouvieri* on the basis of a single male, from the Pungwe Valley, Mozambique, which he compares with Sharp's *hanseni*, but no mention is made as to the source of the material which was considered to represent *hanseni*, while the description is a brief one of the form of the ultimate tergite, ultimate sternite and parameres. Unfortunately in describing the appendages of the ultimate sternite (subgenital plate) the appearance of the process in lateral aspect is not stated, although it is of greater diagnostic value than the absolute direction of the same as seen from the venter. The description of *H. chevalieri*, based on both sexes, from the Ivory Coast is comparative with *talpoides* of Walker, but the new species is said to differ by the greater length of articles seven to eleven of the antennae and the more strongly curved distal process of the ultimate sternite of the male, while certain other peculiarities of the anal appendages in both sexes are considered to be diagnostic.

In the second of these contributions<sup>6</sup> Dr. Chopard refers specimens from eight localities in the Belgian Congo to *H. hanseni*, and a female from Dilolo, which is in the Upper Kasai, Belgian Congo, is described and figured as the allotype of *H. bouvieri*, while males and females from Dilolo and single female specimens from Kitega in Urundi, and Kambove, Katanga, Belgian Congo, are similarly recorded.

In the third of these studies,<sup>6</sup> which is illustrated by a number of useful figures, Dr. Chopard has given us a summary of his conclusions on the

<sup>6</sup> "Diagnoses de deux espèces nouvelles du genre *Hemimerus* Walk. [Dermapt. Hemimeridae]." (Bull. Soc. Ent. France, XXXIX, pp. 242, 243, (December, 1934).)

Here Dr. Chopard describes *H. bouvieri* on the basis of one male from Guengère (not Cuengere), Valley of the Pungwe (Pongue), Mozambique and *H. chevalieri* based on one male and eight females from the Ivory Coast.

"Note sur les *Hemimerus* du Musée du Congo Belge (Dermaptères Hemimeridae)." (Rev. Zool. Bot. Afr., XXVI, pp. 120, 121, figs. 1, 2, (December 29, 1934).)

In this study Dr. Chopard recorded material as *H. hanseni* from eight localities in the Belgian Congo, figures a female of *H. bouvieri* from Dilolo, Belgian Congo, and records males and females from Dilolo and single females from two other Belgian Congo localities as the same species.

"Les *Hemimerus* des collections du Muséum (Ins. Dermaptères)." (Arch. Mus. Nation. Hist. Nat. Paris (6), XII, part 2, pp. 439-445, figs. 1-28, (June, 1935).)

In this recent work of Dr. Chopard's there is presented a brief historical outline of the development of our knowledge of the genus, an analysis of the stages or instars of the immature condition, a comparative discussion of the male genitalia, keys to the species as understood by the author, systematic listing of much of the previous literature and specific assignment of the material of the genus in the collection of the Paris Museum of Natural History.

systematics of the genus as understood by him. Certain of these conclusions, as well as some of the characters used in the keys and presented in the illustrations, call for special comment. The first is in connection with the relative length and breadth of the articles of the antennae, particularly the articles seven to eleven, a feature used by Dr. Chopard to separate his *chevalieri* from *talpoides*. No information is given in any of the papers here discussed as to whether the material on which the studies were based is preserved as dry material or in alcohol. As we are showing in the present paper under *H. hanseni*, material dried from alcohol will give very different proportion ratios when compared with wet material from the same lot of *Hemimerus* taken from the same individual *Cricetomys*. This same series—approximately as large as any of the genus previously reported—shows appreciable variation in the direction and degree of curvature of the process of the ultimate sternite of the male. In the assignment of material to the four species recognized by him, we note that Dr. Chopard feels that the female described as that sex of *bouvieri*, is somewhat nearer to *talpoides* than it is to *hanseni*, contrary to his original assignment when describing the unique male type.

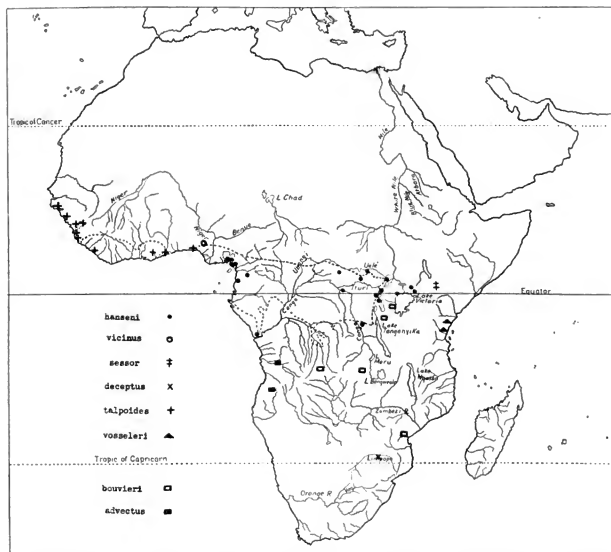
The comment "Presque toutes les études d'anatomie et surtout celles de biologie qui ont été publiées sous le nom de *talpoides* ont été faites sur cette espèce" is by no means true, as by far the greater part of this information has been drawn from the very different *H. vosseleri*, here described.

It is rather difficult to understand why Dr. Chopard has not used one of the most evident features of the ultimate sternite (subgenital plate) in the female sex, *i.e.* the development in some of the species-groups of the genus of what is essentially a double margin of the median production; these margins, the actual margin and the submarginal carina, being separated from each other by a very definite sulciform groove.

In closing this last study Dr. Chopard has briefly commented upon the distribution of the species of *Hemimerus* known to him as compared to that of their *Cricetomys* host. Unfortunately he has made but little investigation along these lines and presents a really incorrect summary of the situation by stating, "il semble que la différenciation des espèces d'*Hemimerus* se soit faite d'une façon complètement indépendante de leur hôte", as we are showing elsewhere in this paper there is to a very marked degree a definite relation between some of the species of *Hemimerus* and at least certain of the forms of the genus *Cricetomys*, their hosts. We are presenting below conclusions as to the association of certain types of *Hemimerus* with particular hair conditions of their host forms.

*Distribution.*—While the distribution of *Hemimerus* probably coincides fully with that of *Cricetomys*, we do not as yet know the ectoparasite from certain peripheral areas where *Cricetomys* has been taken, such as Gambia

and the Bahr-el-Ghazal district. The distribution of *Hemimerus* as far as definitely known extends from Portuguese Guinea across the Upper Guinea region, Nigeria, Cameroons, the lower Congo and as far as central Angola (Caconda), eastward across at least the southern portion of Ubangi-Shari,<sup>7</sup> French Equatorial Africa, the Uele region of the northern Belgian Congo to Uganda and the northern portion of Kenya Colony (Mt. Gargues),



Distribution of the species of the genus *Hemimerus*. (A single record for *H. hansenii*, i.e. that from Mambaka, Belgian Congo, cannot be placed, as the position of that locality cannot be ascertained from any available map.)

south to southern Katanga, Belgian Congo, the Usambara Mountains of Tanganyika Territory, the Pungwe Valley (Guengère) of Mozambique and the northeastern Transvaal. The exact limit of its distribution both to the northward and southward, are not at all clearly defined, owing to the lack of material or information from extensive areas where *Hemimerus*, as well

<sup>7</sup> Although the specimen was unwittingly destroyed by a native assistant, and the species remains unknown, a single *Hemimerus* was present on a *Cricetomys* brought in to the senior author at Fort Sibut, Ubangi-Shari, in October, 1934.



as *Cricetomys*, undoubtedly occurs. The accompanying map graphically presents the distribution of the genus *Hemimerus* and the respective species as far as possible from present information.

*Correlation of External Genitalic Structure of Female with Hair Texture of Host.*—Early in the course of our study we became interested in the remarkable marginal specializations found on the ultimate sternite of the females of the various species of *Hemimerus*. These ranged from what might be called the simple closing of a valve-like plate against the ventral surface of the ultimate tergite, to an opposite extreme in which the margin of the plate, by means of a peripheral grooving and a supplementary shoulder-like flange, could be engaged with specialized portions of the ventral surface of the ultimate tergite, and locked in a position which effectually closes and protects the anal orifice. The obvious value of this latter arrangement in guarding the internal genitalia at once suggested the possibility that some feature of the hair covering of the host might be responsible.

No comprehensive modern systematic study of the forms of the genus *Cricetomys* has appeared, yet a total of twenty-eight forms<sup>8</sup> has been described from various localities in tropical Africa. The literature on the subject consists almost entirely of the descriptions of various new forms, which in nearly every case have been considered to be subspecies of *Cricetomys gambianus* of Waterhouse, the oldest known and genotypic species.

A casual examination of the limited series of *Cricetomys* in the collection of this Academy demonstrated at once that a marked difference in hair texture, length and density was present in the relatively few forms then available. With these observations as a basis the series of *Cricetomys* skins in the United States National Museum and the Museum of Comparative Zoölogy were then examined. In this way we were able to accumulate interesting data from more than one hundred specimens of *Cricetomys*.

While we had before us *Hemimerus* from but a fraction of the localities represented by *Cricetomys*, we were able in certain cases to exactly identify, by field numbers or other incontestable information, the specific individuals from which particular lots of *Hemimerus* were taken. In certain cases these were the type specimens on which forms of *Cricetomys* had been based.

As a result of these observations, two very definite conclusions were reached: first, that from hair texture and character alone the various forms of *Cricetomys* can hardly be considered specifically identical; second, that a very definite correlation of the hair texture and character of the host rat and the degree of specialization of the margin of the ultimate sternite of

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<sup>8</sup> For an annotated list of these we are indebted to Dr. Glover M. Allen.

the female *Hemimerus* does exist. The first conclusion must be referred to our mammalogical friends for elucidation, and in the present study we will refer to the various forms of *Cricetomys*, where discussed under the species of *Hemimerus*, merely by the names which have been applied to them without passing definite judgment as to their relative rank. One factor, however, stands preëminent in regard to the forms of *Cricetomys*, this being the fundamental similarity in hair texture of those forms living in lowland forest and the moister forests of mountain areas. These possess in common softer, denser, and generally shorter hair covering, while those of the gallery forest areas, the drier mountain forests and the scattered forest patches in lands definitely more arid have harsher, often longer and frequently sparser hair covering.

Considering the species of *Hemimerus* in their systematic order, we find that *H. hansenii* possesses a more primitive type of female ultimate sternite, in that it has a submarginal sulciform impression without a submarginal carina. This sternite, when the anal orifice is closed, merely fits against the ventral surface of the ultimate tergite. We have examined *Cricetomys* from three localities from which we have *Hemimerus hansenii*, in two cases definitely the actual hosts of the ectoparasites studied, these being Kimosi, near Kakamega, Kenya Colony and Ekibondo, Uele District, Belgian Congo. In addition we have seen numerous *Cricetomys* from other areas represented in our series of *H. hansenii*. All of these hosts possess rather soft, adpressed and relatively short hair. The Ekibondo host material collected by the senior author clearly represents *Cricetomys emini*.<sup>9</sup>

We have seen no definitely associated material of the host of *Hemimerus vicinus*, and therefore can make no comment on the hair texture. The type of this species is labeled from "*Cricetomys emini*" but in our belief the host rat was probably one of the other forms of the genus described from Nigeria. We are basing this impression on the information we have gathered concerning the correlation of external genitalia with the hair texture of the host rats. The ultimate sternite of the female type of *vicinus* possesses both a well-developed submarginal carina and a submarginal sulciform impression, and the anal orifice can be locked shut by engaging its margin in the specialization of the ventral surface of the ultimate tergite, which is supplied with a flange.

We have seen but a single *Cricetomys* specimen which was beyond question the actual host of *H. vosseleri*. This is from the Taita Mountains of

<sup>9</sup> These specimens have been critically compared with the original description of *C. emini* [described as *C. gambianus emini*] Wroughton (Ann. and Mag. Nat. Hist., (8), V, p. 106, (1910); ♂; Gadda, Mombuttu), and as far as possible to determine they clearly represent that form. The type locality of *emini* is little more than a score of miles to the west of Ekibondo, slightly nearer Niangara, in country of almost identical character.

Kenya Colony, and is the type of Heller's *Cricetomys gambianus enguvi*.<sup>10</sup> The ultimate sternite of the female of *H. vosseleri* possesses both a well-developed submarginal sulciform impression and a submarginal carina, and fits into the specialization of the ventral surface of the ultimate tergite. The known host of *H. vosseleri* has moderately soft hair.

In *H. sessor* we find practically the same type of structure of the margin of the ultimate sternite and of the ventral surface of the ultimate tergite. Material of this species showed conclusively that the ultimate sternite of the female could be definitely locked shut by engaging its margin in the specialization on the ventral surface of the ultimate tergite. The host rats of *H. sessor* formed the original series of *Cricetomys gambianus raineyi* Heller.<sup>11</sup> The hair of *C. g. raineyi* is very remarkable, being quite harsh and rather long, in texture, by far the coarsest seen in any of the forms of the genus examined. This rat clearly represents a highly modified type, living in a distinctive environment.

We possess no information on the hair texture of the rat host of *H. deceptus*, but we do know that the host rat is *Cricetomys gambianus haagneri* Roberts. The species *deceptus* has the same general type of specialization on the distal margin of the ultimate sternite and on the ventral surface of the ultimate tergite as is found in *H. sessor*.

Relative to *H. talpoides* we can supply no exact information on the host, as we have seen no *Cricetomys* which has yielded this species of parasite, or even from the same locality as material of *talpoides* now in hand. This species also has the same type of terminal abdominal specialization found in *seissor* and *deceptus*.

We have seen no definitely associated material of the host of *Hemimerus bouvieri*, and therefore can make no comment on the hair texture. The ultimate sternite of the female of *H. bouvieri* is extremely specialized, in that there exists no trace of either a submarginal sulciform impression or a submarginal carina, and the sternite, when the orifice is closed, fits against a beveled surface on the ventral surface of the ultimate tergite. With *Hemimerus advectus*, however, we can be more explicit, as to the host. The type of this species was taken on the type of *Cricetomys gambianus ansorgei* Thomas, taken at Pungo Andongo, Angola, and we have in the Academy series a single specimen presumably of this rat, from Fuima, Angola, which has the hair rather soft in texture. The form of the ultimate sternite in the female of *H. advectus* is essentially the same as that of *H. bouvieri*. Very probably we shall find the hosts of these two forms have very similar hair structure.

<sup>10</sup> Smith. Misc. Coll., LIX, no. 16, p. 16, (1912).

<sup>11</sup> Smith. Misc. Coll., LIX, no. 16, p. 15, (1912).

From the evidence above briefly analyzed it is clear that females of the forms of *Hemimerus* living on *Cricetomys* hosts with soft, rather short and adpressed hair appear to be under no great necessity for tightly closing or locking the anal orifice. Conversely those known to live on animals with harsh, rather long and less adpressed hair possess a definite ability to tightly close and even lock the anal orifice. The conclusion naturally suggested is that progress through the hair of rats with soft, adpressed hair presents fewer impediments than movement through the hair covering of harshly and sparingly coated hosts.

*Descriptive Terms.*—In the present study certain terms not previously used have been found necessary in discussing features of systematic value.

The median production of the ultimate sternite of the female is the broadly arcuate, sublobiform portion of the sternite occupying what may be called, the inter-cercal area. This is the section of the sternite which bears, when present, the submarginal sulciform impression (see below) and the submarginal carina (see below).

The submarginal sulciform impression or submarginal sulcation of the ultimate sternite of the female consists of a shallow channel or groove proximad of the actual margin of this sternite. Depending on the species it may or may not be concentric with the actual margin.

The submarginal carina of the ultimate sternite of the female is a supplementary margin which is more ventral in position than the actual margin, from which it is separated by the submarginal sulciform impression or by a submarginal channel or groove. In its extreme condition it is a further development of the gradual rise found proximad of the submarginal sulciform impression in the more generalized *Hanseni* Group.

The proximo-lateral sulciform impressions are the paired depressed linear areas on the ultimate sternite of the female. They usually start at the lateral bases of the median, lobe-like production and extend more or less proximad, but varying in their exact direction with the species. These areas are depressed for a varying distance towards or to the evident base of the sternite. There seems to be some definite structural weakness along these impressions, as in some species they split at the distal extremity.

The production of the ultimate sternite of the male is the process developed where the two portions of the distal margin converge. This structure, which is usually situated slightly dextrad or sinistrad of the median line, varies in outline and position with each species; it is in general form either spur-like or digitiform, in exact outline definitely and specifically diagnostic. The direction as given in the present paper is that as would be seen from the dorsum, or as evident when the insect is inverted and the ventral surface examined with the abdominal extremity directed away from the viewer.

*Species Groups.*—The Hanseni Group, which contains only the typical species (*hanseni*), may be briefly characterized as follows. In the female sex the ultimate tergite is broadly transverse, the greatest width being more than one and one-half times the median length. Distal margin of this tergite evenly arcuate. The ventral surface of the ultimate tergite concave mesad. The ultimate sternite with a shallow submarginal sulciform impression on the median lobe, but without a definite submarginal carina. Not capable of locking the anal orifice, the ultimate sternite merely fitting closely against the ventral surface of the ultimate tergite. The proximolateral impressions of the ultimate sternite extend for a varying distance toward the evident base of the sternite, evenly developed and not prominent. In the male sex the process of the ultimate sternite is directed dextrad and is vomeriform in lateral outline. It is without any well-developed blade-like portion or a very distinct proximal shoulder. Penultimate tergite with a definite and distinct median angle on the distal margin. The ultimate tergite is broadly transverse. This species group seems to be the most primitive of the four groups of the genus. In practically all differential characters it is more generalized and is probably more closely related to the common ancestral stock than any of the other known forms.

The Vicinus Group, which contains only the typical species (*vicinus*), may be characterized by its unusual combination of diagnostic features. This group, of which only the female sex is known, has the ultimate tergite broadly transverse, the greatest width at least one and one-half times the median length, the distal margin subtruncate. The ventral surface of the ultimate tergite is deplanate and supplied with a flange to engage the distal margin of the ultimate sternite. The ultimate sternite has a well-developed submarginal carina and a shallow groove between this and the actual margin. The distal portion of the ultimate sternite locks into the ventral surface of the ultimate tergite. This group has some of the characters of the primitive Hanseni Group and also some of those of the more specialized Talpoides Group.

The Talpoides Group, which contains four related species (*vosseleri*, *seissor*, *deceptus* and *talpoides*), is in many respects probably the most highly developed group of the genus. The female of this group has the ultimate tergite subtrigonally, trigonally, or trapezoidally produced, the ventral surface being concave, convex or rarely deplanate, and always supplied with a flange for engaging the distal margin of the ultimate sternite. The ultimate sternite always has a definite, well-marked, submarginal carina and a shallow or deep submarginal impression or groove. The distal portion of the ultimate sternite locks into the ventral surface of the ultimate tergite so that the anal orifice may be tightly closed. In the males of the members of this species group the process of the ultimate sternite is directed

sinistrad. The ultimate tergite is transverse with the median portion of its distal margin truncate, subtruncate or semicircular, while the distal margin of the penultimate tergite is truncate, or shallowly concave. In lateral view the process of the ultimate sternite, in the known males of the species of this group, is either claw-like without a well-developed peduncle, or with a developed peduncle and with or without an apical lobe on the dorsal margin.

The *Advectus* Group, which has two species (*advectus* and *bouvieri*), is a relatively aberrant one, probably representing a line diverging from the original phylum more remotely than the other groups. The females of this group have the ultimate tergite produced, either trapezoidally or trigonally, the ventral surface deplanate. The ultimate sternite does not have a submarginal carina nor a submarginal sulciform impression or groove. The ultimate sternite fits into an excavate area, which has a beveled margin, on the ventral surface of the ultimate tergite. The anal orifice is not locked shut, but the ultimate sternite fits tightly into the excavate area so as to protect the internal organs. The males of this group have the process of the ultimate sternite directed dextrad, and in lateral view non-vomeriform. Penultimate tergite either distally truncate or with the lateral portions of the distal margin of the penultimate tergite produced and the ultimate tergite semi-ovate.

*Phylogenetic Arrangement of Species Groups.*—The *Hanseni* Group is without doubt the most primitive and generalized of those into which the genus is here divided, and from the neighborhood of this generalized type there seem to be two lines of development. The first embraces the *Vicinus* and *Talpoides* Groups, of which the latter represents the extreme development along this line, with the *Vicinus* Group occupying an intermediate position between it and the generalized *Hanseni* Group. Secondly, the *Advectus* Group is apparently derived from a more ancestral stock than the present *Hanseni* Group, has pursued its own line of development and, in the features utilized for specific differentiation, has little in common with most of the other known members of the genus.

#### *Key to the Species of Hemimerus*

- |  |   |
|--|---|
| 1. Females .....   | 2 |
| Males .....  | 9 |
| 2. Ultimate tergite broadly transverse, greatest width equal to at least one and one-half times median length .....  | 3 |
| Ultimate tergite symmetrically trapezoidal or subtrigonal, median length subequal to or greater than greatest width .....  | 4 |
| 3. Ultimate tergite with distal margin arcuate, ventral surface of same concave; ultimate sternite without a definite submarginal carina and with at most a shallow sulciform submarginal impression; not capable of locking or closing the anal orifice, ultimate sternite merely fitting closely against ventral portion of ultimate tergite. Habitat: |   |

- Southern Nigeria, Cameroons, Belgian Congo, Uganda Protectorate and western Kenya Colony ..... (Hanseni Group) *hanseni* Sharp
- Ultimate tergite with median portion of distal margin subtruncate, ventral surface of same deplanate; ultimate sternite with a definite submarginal carina; distal portion of this sternite locked by means of a flange into an excavate area on ventral surface of ultimate tergite. Habitat: Nigeria ..... (Vicinus Group) *vicinus* new species
4. Penultimate tergite with distal margin not greatly produced; ventral surface of ultimate tergite deplanate; ultimate sternite without a submarginal carina or a sulciform impression; distal portion of this sternite fitting into an excavate area on ventral surface of ultimate tergite ..... (Advectus Group) 5
- Penultimate tergite with distal margin trigonally produced; ventral surface of ultimate tergite usually either concave or convex, occasionally deplanate; ultimate sternite with a definite submarginal carina and a submarginal groove or channel; distal portion of this sternite locked, by means of a flange, into an excavate area on ventral surface of ultimate tergite or merely fitting closely against this portion of ultimate tergite ..... (Talpoides Group) 6
5. Penultimate tergite with a slight median production on distal margin; ultimate tergite with apex narrowly rounded; ultimate sternite with lateral margins of median production weakly sigmoid. Habitat: Portuguese East Africa, Belgian Congo and Tanganyika Territory. *bouvieri* Chopard
- Penultimate tergite with distal margin truncate; ultimate tergite with apex subtruncate; ultimate sternite with lateral margins of median production oblique. Habitat: Angola ..... *advectus* new species
6. Ultimate tergite with apex rather broadly rounded, ventral surface concave mesad; distal portion of ultimate sternite not definitely locking, by means of a flange, into ventral surface of ultimate tergite. Habitat: Tanganyika Territory and Kenya Colony. *vosseleri* new species
- Ultimate tergite with apex rather narrowly rounded, ventral surface usually convex, occasionally deplanate; distal portion of ultimate sternite locking, by means of a flange, into ventral surface of ultimate tergite ..... 7
7. Penultimate tergite with distal margin evenly curved to the rounded subobtus-angulate midpoint; ultimate tergite with ventral surface more or less deplanate; ultimate sternite with margin of median production and submarginal carina evenly rounded, and practically concentric. Habitat: Kenya Colony ..... *sensor* new species
- Penultimate tergite with lateral margins arcuate to the angulate midpoint; ultimate tergite with ventral surface convex; ultimate sternite with margin of median production and submarginal carina not evenly arcuate, either semi-ovate or flattened mesad, submarginal carina not practically concentric with actual margin ..... 8
8. Ultimate sternite with margin of median production distinctly flattened mesad and with submarginal carina almost always flattened mesad; apex of ultimate tergite rounded. Habitat: Liberia, Portuguese

- Guinea, French Guinea, Sierra Leone, Ivory Coast, Gold Coast and Nigeria ..... *talpoides* Walker
- Ultimate sternite with margin of median production semi-ovate, submarginal carina subobtusely angulate; apex of ultimate tergite narrowly rounded. Habitat: Northeastern Transvaal.
- deceptus* new species
9. Process of ultimate sternite pointing sinistrad; median portion of distal margin of penultimate tergite truncate or shallowly concave ..... 10
- Process of ultimate sternite pointing dextrad; median portion of distal margin of penultimate tergite truncate or slightly produced mesad . 12
10. Ultimate tergite semi-circular, not broadly transverse; process of ultimate sternite without a well-differentiated peduncle, this process claw-like, see Figure 38 ..... *talpoides* Walker
- Ultimate tergite transverse, median portion of distal margin truncate or subtruncate; process of ultimate sternite with a well differentiated peduncle ..... 11
11. Penultimate tergite with distal margin truncate; ultimate tergite with greatest length equal to one-fourth of proximal or one-half of apical width; process of ultimate sternite with dorsal margin evenly arcuate.
- vosseleri* new species
- Penultimate tergite with distal margin shallowly concave; ultimate tergite with median length equal to one-half of proximal or three-fifths of apical width; process of ultimate sternite with an apical lobe on the dorsal margin ..... *deceptus* new species
12. Penultimate tergite with distal margin truncate; process of ultimate sternite, in lateral view, shaped like a meat cleaver, see Figure 41.
- advectus* new species
- Penultimate tergite with distal margin mesad produced; process of ultimate sternite, in lateral view, not shaped like a meat cleaver .. 13
13. Penultimate tergite with distal margin broadly obtuse-angulate, with a definite and distinct median angle, see Figure 30; ultimate tergite broadly transverse; process of ultimate sternite, in lateral view, vomeriform, see Figure 36 ..... *hanseni* Sharp
- Penultimate tergite with lateral portions of distal margin produced, see Figure 34; ultimate tergite semi-ovate; process of ultimate sternite, in lateral view, not vomeriform, see Figure 40 .... *bouvieri* Chopard
- The males of *vicinus* and *seissor* are not known.

**Hemimerus hanseni** Sharp. Figs. 1, 9, 10, 18, 24, 30, 36 and 42.

*Hemimerus talpoides* Hansen (not *Hemimerus talpoides* Walker), Ent. Tidskr., 1894, p. 65, pls. 2 and 3, (1894), [♂, ♀; Rio del Rey (Old Calabar District, Nigeria) or Kitta, Cameroons, ("On *Cricetomys gambianus*")].—Saussure, Rev. Suisse Zool., IV, p. 277, pl. X, (specific name mentioned only on the explanation to the plate), (1896), [♀; from Aurivillius, presumably from either Rio del Rey or Kitta].—Bormans and Krauss, Das Tierreich, Lief. 11, Orth., Forficulidae und Hemimeridae, p. 132, fig. 47, (in part), (1900).—Jordan, Novit. Zool., XVI, p. 327, figs. 1-10, (1910), [♂, ♀; British Ruwenzori Exped. (on *Cricetomys* sp.)].—Burr, Genera Insect., fasc. 122, p. 8, (in part), (1911).—Schouteden, Bull. Soc. Ent. Belgique, I, p. 36, (1919), [adults and juvs. (sex not stated); Ituri, Belgian Congo ("on *Cricetomys gambianus emini*")].

*Hemimerus hanseni* Sharp, Cambr. Nat. Hist., V, p. 218, figs. 114-116. (1895).—Kirby, Syn. Cat. Orth., I, p. 59, (1904).—Carpenter, Ent. Month. Mag., XLV, p. 256, (1909), [♀; Entebbe, Uganda, ("on *Cricetomys* presumably *gambianus*")].—Rehn.



Bull. Amer. Mus. Nat. Hist., XLIX, p. 352, (1924), [♂, ♀; Region of the Uele, Belgian Congo ("on *Cricetomys gambianus*")].—Bequaert, in Strong, Afr. Repub. Liberia, 1930, II, p. 824. (1930), [Sex ?; Burunga, Kivu, Belgian Congo ("off *Cricetomys gambianus*")].—Chopard, Rev. Zool. Bot. Afr., XXVI, fasc. 1, p. 120, (1934), [♂, ♀; juv.; Ile Bertha, Belgian Congo, (on "*Cricetomys emini*")]: ♂, ♀, juv.; Kotili, (on "*Cricetomys emini emini*"): ♂, ♀; Lampa, Mayumbe, (on "*Cricetomys emini*"): ♂, ♀; Lulenga, Kivu, (on "*Cricetomys emini preparator*"): ♂, ♀, juv.; Mambaka, (on "*Cricetomys emini emini*"): ♂, juv.; Medje, Ituri,<sup>12</sup> (on "*Cricetomys emini emini*"): ♂, juv.; Pilipili, (on "*Cricetomys emini emini*"): ♂, ♀; Djugu, Ituri, (on "*Cricetomys emini*")].—Chopard, Arch. Mus. Nation. Hist. Nat. Paris, (6), XII, part 2, pp. 443, 444, figs. 2-9, 11, 12, 18, 22, 27, 28, (1935), [♂, ♀, juv.; Mount Elgon, East Africa, (on "*Cricetomys gambianus elgonis*")].

*Original material.*—The original material before Hansen, as stated by him, consisted of four specimens *i.e.* two females, one male, and one young, all of which were secured by Dr. Y. Sjöstedt in 1891 in the "Cameroons", and were taken at either Kitta or Rio del Rey, the latter of which is in the Old Calabar District of the present Nigeria.<sup>13</sup> Through the courtesy of Dr. Kai L. Henriksen, of the Zoological Museum of the University of Copenhagen, we are able here to select as lectotype of this species, one of the two original female specimens examined by Hansen. The other female, *i.e.* that treated with caustic potash, the male and the young, used by Hansen when writing his paper for the Entomologisk Tidskrift have evidently been destroyed or lost. The female lectotype is in the collection of the University of Copenhagen Zoological Museum, and is labelled "*Hemimerus hanseni* Sharp Type!"; with this specimen they also have some embryos, evidently those found by Hansen.

*Comparison.*—This species, which is known from both sexes, is the sole member of the very distinctive Hanseni Group.

The female sex of *hanseni* differs from that sex of all the other known forms except the sole member of the Vicinus Group by having the ultimate tergite broadly transverse, the greatest width equal to at least one and one-half times the median length. This sex of *hanseni* differs from that of all the other forms except *vosscleri* by having the ventral surface of the ultimate tergite concave mesad. The female of this species differs from that of all the other known species by having a shallow submarginal impression, but no submarginal carina, on the production of the ultimate sternite.

The male sex of *hanseni* differs from that of the Talpoides Group by having the process of the ultimate sternite directed dextrad instead of sinistrad. This sex is distinguished from that of *advectus* by having the

<sup>12</sup> In error given as "Haut-Ituri". There is and has been no district of "Haut-Ituri", and Medje is by no stretch of reasoning on the upper course of the Ituri River.

<sup>13</sup> Hansen (*Idem*, p. 81) has given a portion of a letter from Sjöstedt bearing on the capture of these specimens. The species was taken at both localities, which are near to one another and in the same general type of rain-forest country, but it is not possible to determine exactly which locality was represented by that portion of the series discussed by Sjöstedt, which was before Hansen. Kitta is directly northwest of the Cameroon Mountains, situated at 9° 4' E., 4° 50' N., while Rio del Rey is on the great Calabar estuary at 8° 45' E., 4° 45' N.

distal margin of the penultimate tergite mesad produced instead of truncate. From *bouvieri* it differs by having the ultimate tergite broadly transverse instead of semi-ovate, and the process of the ultimate sternite, when viewed laterad, is vomeriform instead of shaped more or less like a meat cleaver.

*Specific characters.*<sup>14</sup>—Form and proportions of head, antennae, pronotum, mesonotum, metanotum, sterna, and limbs as detailed in the generic description. There are no specific differential characters in any of these portions of the body.

General form of the abdomen as diagnosed under the genus, the terminal segments alone exhibiting differential specific features.

*Female.*—In the female sex the penultimate tergite is transverse, its entire margin in general form subobtusely arcuate; supra-cercal portions of the margin appreciably but weakly sigmoid, being subconvex proximo-laterad and toward the median line subconcave; these sections of the margin passing by a faint but appreciable angulation into the more transverse median section which is equal in width to two-fifths that of the whole tergite, and broadly obtuse-angulate with medio-distal point rounded. In lateral view the dorsal line of the ultimate tergite is seen to form an obtuse-angle with that of the penultimate tergite, the former being deflexed ventro-caudad.

Ultimate tergite of female in general form transverse, its free margin semicircular, its greatest visible (proximal) width, as seen from the dorsum, being equal to nearly twice its greatest length; proximal width of the tergite contained slightly more than two and one-half times in the proximal width of the penultimate tergite: ventral surface of ultimate tergite and adjacent genital aperture broadly concave, vaulted, this concavity gradually narrowing caudad, ventral surface of the free margin of ultimate tergite armed with spaced, heavily, rather short chaetae.

Ultimate sternite of female transverse, with median production semi-ovate, greatest length of the central production from its base line is to its greatest width as 10 is to 17; production of this sternite with a shallow sub-marginal sulciform impression, which is more definitely semi-ovate than the margin itself, approaching the latter more closely meso-distad than laterad; the proximo-lateral diverging sulciform impressions extending to or almost to the evident base of the sternite, dextral impression broader proximad, less narrowly sulciform and more excavate<sup>15</sup> than sinistral.

Cerci as described under the genus.

*Male.*—In the male sex the only diagnostic features, as in the female, are found in the terminal abdominal segments.

Penultimate tergite of male transverse, in general form symmetrically trapezoidal, width of distal margin equal to two-thirds of proximal width of tergite, lateral margins oblique, convergent, passing into the distal margin by a rounded obtuse-angulation; distal margin broadly obtuse-angulate, median angle of same distinct and definite, the portion of the margin laterad of same concave or sub-concave to a varying degree. In lateral view, dorsal

<sup>14</sup> This description is drawn from three females and two males from the Cameroons, (i.e. two males and one female from Batanga and two females from Lolodorf).

<sup>15</sup> This may indicate a step toward the condition found in certain other forms of the genus in which the dextral one splits to some degree.

line of penultimate tergite in a somewhat different plane from that of the ultimate, the latter slightly deflexed ventro-distad.

Ultimate tergite of male, as seen from the dorsum, in general form transverse, broad and flattened, greatest length equal to one-half of apical width, or one-third of greatest (proximal) width.

Ultimate sternite of male in general form transverse trigonal, slightly asymmetrical,<sup>16</sup> brief lateral margins relatively short and very slightly convergent distad, passing roundly into those of the more distal trigonal portion of the sternite, sinistral margin of trigonal production shallowly subobtusely angularly concave, dextral margin of the same evenly and distinctly sigmoid, apex of sternite developed into a brief but distinct, moderately decurved, compressed vomeriform process, the immediate apex of which is directed slightly dextrad, peduncle of the process, in lateral view, narrower than greatest width (fig. 36).

Cerci as in the female and other members of the genus.

Parameres; for illustration of these appendages see Fig. 42.

*Measurements (in millimeters) of representative individuals of  
Hemimerus hansenii*

	Length of body (exclusive of cerci)	Median length of entire thorax	Greatest width of mesonotum
♀, Lolodorf, Cameroons .....	(dry) 9.5	3.6	4.
♀, Lolodorf, Cameroons .....	(dry) 8.5	3.8	4.
♀, Lolodorf, Cameroons .....	(dry) 8.	3.8	4.
♀, Lolodorf, Cameroons .....	(dry) 9.3	3.9	3.9
♀, Lolodorf, Cameroons .....	(dry) 9.5	4.	3.9
♀, Batanga, Cameroons .....	(dry) 9.7	4.	3.9
♀, Region of the Uele, Belgian Congo ..	(dry) 10.5	3.8	3.8
♀, Region of the Uele, Belgian Congo ..	(dry) 11.	3.8	4.
♀, Ekibondo, Uele, B. C. ....	(dry) 10.5	3.8	3.9
♀, Ekibondo, Uele, B. C. ....	(dry) 10.5	3.8	3.9
♀, Ekibondo, Uele, B. C. ....	(dry) 10.5	3.8	3.8
♀, Ekibondo, Uele, B. C. ....	(dry) 10.3	3.6	3.8
♀, Ekibondo, Uele, B. C. ....	(alc.) 11.5	4.3	4.3
♀, Ekibondo, Uele, B. C. ....	(alc.) 11.5	4.	4.
♀, Mt. Elgon, Uganda .....	(dry) 10.	3.8	3.8
♀, Mt. Elgon, Uganda .....	(dry) 9.5	3.6	3.9
♀, Mt. Elgon, Uganda .....	(alc.) 11.5	3.4	3.8
♀, Mt. Elgon, Uganda .....	(alc.) 11.	3.6	3.8
♀, Mt. Elgon, Uganda .....	(alc.) 11.	3.3	3.8
♀, Uganda <sup>17</sup> .....	(dry) 12.9	4.	3.8
♀, Kaimosi, Kenya .....	(dry) 11.	3.8	3.6
♀, Kaimosi, Kenya .....	(dry) 10.9	4.4	3.7
♀, Kaimosi, Kenya .....	(dry) 10.9	4.2	3.9
♂, Batanga, Cameroons .....	(dry) 9.5	3.6	3.6
♂, Batanga, Cameroons .....	(dry) 9.5	3.7	3.4
♂, Ekibondo, Uele, B. C. ....	(dry) 10.	3.8	3.7
♂, Ekibondo, Uele, B. C. ....	(dry) 10.	3.6	3.8
♂, Ekibondo, Uele, B. C. ....	(alc.) 11.	3.8	3.6
♂, Ekibondo, Uele, B. C. ....	(alc.) 11.3	3.7	3.9
♂, Mt. Elgon, Uganda .....	(dry) 9.5	3.	3.6
♂, Mt. Elgon, Uganda .....	(dry) 9.2	3.6	3.8
♂, Kaimosi, Kenya .....	(dry) 10.5	3.6	3.5
♂, Kaimosi, Kenya .....	(dry) 10.5	3.6	3.4

<sup>16</sup> No definite proportions of length to breadth can be given as this sternite is to some extent retractile.

<sup>17</sup> This specimen has been greatly flattened.

*Variation.*—The series of females before us shows considerable variation in the form of the distal margin of the penultimate tergite. This margin may be subtruncate with a very slight median arcuation, or it may have a distinct subtriangular median production with the more lateral portions of the distal margin subconcave or even concave. The specimens from Lolodorf and Batanga, Cameroons are largely of the type without the production, while those from Ekibondo, Uele District, Belgian Congo and Mount Elgon, Uganda are predominatingly of the type with the subtriangular production. The three female specimens from Kaimosi, Kakamega, Kenya Colony show the extremes of variation in the shape of the distal margin, one having this margin subtruncate, another with a slight median production and the third with a very prominent median angulation. Moreover, none of the series here examined are all of one type. The ultimate sternite of the female shows but little variation except in the proximo-lateral impressions, which extend a varying distance toward the evident base of the sternite.

The series of males shows little variation in any of the characters used above, except the relative direction of the process of the ultimate sternite, and this varies in lateral view from pointing caudad to almost directly ventrad. There is also some very slight variation in the rounding of the lateral portions of the free margin of the ultimate sternite where they pass into the more distal trigonal section of the same.

As the relative length to breadth of certain of the more proximal antennal segments has been used as a specific diagnostic character in this genus by Dr. Chopard, the results of an examination of both wet and dry material of this species from the same locality, and from the same lot of material taken the same day from two individuals of *Cricetomys*, may be of interest. The analysis here given shows conclusively that dry material and wet material of unquestionably the same species supply different ratios. Material dried from alcoholic preservation, apparently by contraction of inter-segmental tissue, produces the effect of a shorter and broader antennal segment, while alcoholic material, as stated above from the same source, shows a greater percentage of length to breadth, the segments not being invaginated as seems to be the case with specimens dried after alcoholic preservation.

*Distribution.*—From extreme southeastern Nigeria (Rio del Rey, Old Calabar) south to the Mayumbe District (Lampa) of the lower Congo, eastward to the Lake Kivu district,<sup>18</sup> Belgian Congo, across Uganda (Entebbe and Mt. Elgon), as far as extreme western Kenya Colony (Kaimosi, Kakamega), northward as far as the Uele River (Ekibondo), Uele District, and reaching southward at least to Pilipili, Maniema

<sup>18</sup> Lulunga according to Dr. Chopard, probably an error in transliteration for Lubango, an administrative base in the Kivu District. Burunga similarly is situated to the northeast of Lake Kivu.

District, Belgian Congo. Faunistically the species probably occurs throughout the Lower Guinea Forest District<sup>19</sup> and is intrusive in the Ubangi-Uele Savanna District, the Uganda-Unyoro Savanna, and even into the East African Highland District. Its occurrence in these latter districts is probably influenced very largely by the presence of gallery or similar forest habitats for its host.

*Relative grating proportions of certain antennal articles of sixteen (8♂, 8♀) specimens of Hemimerus hanseni from Ekibondo, Uele District, Belgian Congo*

MALES						
Article .....	7	7	8	8	9	9
	Length	Width	Length	Width	Length	Width
Dry .....	3.5	2.	3.+	2.—	3.	1.7
Dry .....	3.5	2.	—	—	—	—
Dry .....	4.	2.	3.5	2.—	3.—	2.—
Alcoholic .....	4.6	2.	4.2	2.	4.—	2.
Alcoholic .....	4.5	2.	4.2	2.	3.8	2.
Alcoholic .....	4.5	2.	4.	2.—	4.	1.8
Alcoholic .....	4.+	2.	4.	2.	3.8	2.
Alcoholic .....	4.5	2.+	4.	2.	3.8	2.
FEMALES						
Article .....	7	7	8	8	9	9
	Length	Width	Length	Width	Length	Width
Dry .....	3.+	2.5	3.	2.5	2.5	2.3
Dry .....	3.+	2.5	3.	2.3	2.5	2.
Dry .....	3.5	2.	3.2	2.—	3.	1.7
Dry .....	3.	2.2	3.	2.2	2.7	2.+
Dry .....	3.2	2.2	3.	2.+	3.	2.+
Alcoholic .....	3.+	2.	3.	2.	3.	2.
Alcoholic .....	3.5	2.	3.+	2.	3.—	2.
Alcoholic .....	3.5	2.+	3.2	2.	3.	2.+

*Host association.*—The greater portion of the available information in the published literature as to the host of *H. hanseni* gives *Cricetomys emini* (in its two geographic races *C. e. emini* and *C. e. proparator*) as the vector. Hansen in 1894, Carpenter in 1909, Rehn in 1924 and Bequaert in 1930 reported this species as taken from *Cricetomys gambianus*, while the Lolo-dorf and Batanga specimens here reported are also labelled as taken from that form. There is little doubt in our minds that these *Cricetomys* specimens were erroneously determined individuals of *emini*, which may prove to be the sole lowland forest type of the genus. The Mt. Elgon material reported by Dr. Chopard is said to have been taken from *C. gambianus elgonis*. In the absence of any modern authoritative study of the relationship of the various forms of *Cricetomys* it is not possible to comment further on the affinity of *elgonis*, whether with the forest *emini* or the *gambianus* complex of more open areas.

<sup>19</sup> As defined by Chapin (Bull. Amer. Mus. Nat. Hist., LXV, p. 90, (1932)).

*Habits*.—The past literature supplies no information of importance on the habits of this species, other than its occurrence as an ectoparasite. In October, 1934 the senior author, while at Ekibondo's Village near the Uele River, between Niangara and Dungu, Belgian Congo, had the opportunity to examine a number of fresh specimens of *Cricetomys emini emini*, and of these three were found to bear *Hemimerus*. From two *Cricetomys* over forty *hanseni* in various stages of development were taken, while the third yielded three parasites. One of these two rats which yielded the large series was badly infested with bots, while other *Cricetomys* which bore no *Hemimerus* were quite mangy in appearance, with numerous, although small, partially bald areas scattered over their bodies. Individuals of *Hemimerus* were quite generally distributed over the animals and exceedingly active in eluding capture, slipping through the hair in a surprisingly flea-like manner, when their size was considered. When removed to a flat surface they progressed much like a cockroach but more slowly.

*Specimens examined*.—116; 46 ♀, 33 juv. ♀, 17 ♂, 15 juv. ♂, 5 juv. sex uncertain.

Victoria Lake, Cameroons: (Preuss, "auf erdferkeln"); 1 ♀; [U.S.N.M.].

Buea, Cameroon Mt., Cameroons; September-October, 1929; 3232 feet; 5 ♀, 2 ♂, 2 juv. ♂; [Carnegie Mus.].

Lolodorf, Cameroons; December 24, 1914; (A. I. Good; "on *Cricetomys gambianus*"); 4 ♀, 2 juv. ♀, 2 juv. sex uncertain; [Carnegie Mus.]: April, 1923; (A. I. Good); 3 ♀, 2 juv. ♀, 2 juv. sex uncertain; [Carnegie Mus.].

Batanga, Cameroons; November 8, 1915; (A. I. Good, "on *Cricetomys gambianus*"); 1 ♀, 2 ♂, 2 juv. ♂; [Carnegie Mus.].

Region of the Uele, Belgian Congo; (Dr. Rodhain, "on *Cricetomys gambianus*"); 2 ♀, 2 juv. ♀, 1 juv. ♂, 1 juv. sex uncertain.

Ekibondo, between Niangara and Dungu, Uele, Belgian Congo; October 4, 1934; 2650 feet; (1934 George Vanderbilt African Exped., J. A. G. Rehn, on *Cricetomys emini emini*); 12 ♀ (6 alc., 6 dry), 23 juv. ♀ (10 alc., 13 dry), 5 ♂ (3 alc., 2 dry), 5 juv. ♂ (2 alc., 3 dry): October 6, 1934; 2650 feet; (1934 George Vanderbilt African Exped., J. A. G. Rehn, on *Cricetomys emini emini*); 3 ♂, 1 juv. ♂.

Mt. Elgon, Uganda; (G. W. Foster); 13 ♀ (6 alc., 7 dry), 4 juv. ♀ (2 alc., 2 dry), 3 ♂ (2 alc., 1 dry), 3 juv. ♂ (1 alc., 2 dry). [B.M.N.H.].

Uganda; (E. Degan); 2 ♀; [B.M.N.H.].

Kaimosi, Kakamega, Kenya Colony; February 10-13; (A. Loveridge, on "*Cricetomys emini*"); 3 ♀, 2 ♂. [M.C.Z.].

*Hemimerus vicinus*,<sup>20</sup> new species. Figs. 2, 11 and 19.

This species, known only from the unique female type, is intermediate in character between the *Hanseni* and the *Talpoides* Groups, and is the sole member of the *Vicinus* Group.

<sup>20</sup> From *vicinus*, meaning near.

*Comparison.*—The female of this species is closely related to those of the Talpoides Group, but differs from them, as well as from all those of the other known forms except *advectus*, in having the ultimate tergite symmetrically trapezoidal with the immediate apex truncate instead of subtrigonal or evenly arcuate. The shape of the median portion of the distal margin of the penultimate tergite resembles that of *vosseleri*, and differs from that of all the other forms, by being subarcuato-truncate instead of truncate or mesad produced. This sex differs from those of the Hanseni and Advectus Groups, and resembles those of the Talpoides Group, by having a submarginal carina, or supplementary margin, on the production of the ultimate sternite. From the female of *vosseleri* it differs in having the ventral surface of the ultimate tergite deplanate instead of mesad concave. The production of the ultimate sternite of the female resembles that of *deceptus*, since the submarginal carina is subobtusely arcuate, not following the curvature of the actual margin, and in consequence not concentric with it. At the lateral bases, however, the submarginal carina is practically contiguous with the actual margin.

The male of this species is not known.

*Type.*—♀; Ife,<sup>21</sup> Nigeria. (A. D. Pearse.) ("From *Cricetomys emini*." [United States National Museum.]

As in the other forms of this genus the only specific features are in the terminal abdominal segments.

Penultimate tergite broadly transverse, in general form symmetrically trapezoidal, greatest visible length equal to approximately one-third the greatest visible (proximal) width, or equal to slightly more than one-half of caudal width; lateral portions of distal margin gradually arcuato-convergent distad to a point where the distance between them is slightly less than twice the greatest length of the tergite; median portion of this margin, which is slightly notched, evenly arcuate;<sup>22</sup> penultimate tergite and ultimate tergite with their axes in almost the same plane, that of the ultimate tergite slightly deflexed ventro-caudad.

Ultimate tergite transverse, symmetrically trapezoidal, greatest median length equal to approximately three-fifths of apical width, or one-third of greatest visible (proximal) width;<sup>23</sup> lateral margins oblique convergent caudad, distal margin weakly subarcuato-truncate; ventral surface of ultimate tergite deplanate, not armed with setae.

Ultimate sternite transverse, with the usual median production, which is sub-semicircular, laterad more strongly arcuate; submarginal carina

<sup>21</sup> Ife is in the Lagos District of Nigeria, situated at approximately 40° 40' W. and 7° 25' N.

<sup>22</sup> This specimen has been somewhat flattened, as it was a slide mount. From our knowledge of the other forms of the genus we feel that this portion of the margin has been distorted, and that normally, in all probability, it would be either weakly arcuate or possibly subtruncate.

<sup>23</sup> This measurement may not be entirely accurate for better preserved material, as the specimen may have been flattened in slide preparation.

prominent, subobtusely arcuate, not following arcuation of the actual margin, approaching it most closely at the median line and practically contiguous with it at the lateral bases; when viewed laterally the area between these two margins is slightly sulciform, appearing as a shallow channel.

Cerci as in other members of the genus.

Length (exclusive of cerci), 12.8 mm.; greatest width of mesonotum, 4.2 mm.; length of thorax, 4.5 mm.

*Distribution*.—This species being known only from a single locality in Nigeria, it is practically impossible to even hazard a guess as to its probable distribution.

*Host association*.—It is our belief that the host rat of this specimen was not true *Cricetomys emini*, as it is labeled, but probably one of the other forms of the genus described from Nigeria. We are basing this impression on the information we have gathered concerning the correlation of external genitalia with the hair texture of the host rat.

*Specimens examined*.—1 ♀, (type).

***Hemimerus vosseleri*, new species.** Figs. 6, 15, 21, 27, 33, 39 and 45.

*Hemimerus talpoides* Vosseler, (not *Hemimerus talpoides* Walker), Pflanzer, Tanga, II, p. 63, (1906), [Amani, Usambara, Tanganyika Territory, (on "*Cricetomys gambianus*") ].—Vosseler, Zool. Anzeiger, XXXI, p. 436, (1907), [Amani, Usambara, Tanganyika Territory, (from "*Cricetomys gambianus*") ].—Heymons, Verhandl. Deutschen. Zool. Gesell., 1909, p. 97, figs. 1-3, (1909), [material from Vosseler, presumably a female from Amani, (on "*Cricetomys*") ].—Heymons, Deutsche Ent. Zeitsch., 1911, p. 163, (1911), [material from Vosseler, presumably from Amani, (on "*Cricetomys*") ].—Heymons, Zool. Jahrb., Suppl. XV, (part 2), p. 141, pls. 7-11, text figs., (1912), [♂, ♀; material from Vosseler, presumably from Amani, (on "*Cricetomys*") ].

(?) *Hemimerus hansen* Gedge, (not *Hemimerus hansen* Sharp), Ent. Month. Mag., LVII, p. 91, (1921), [♀; Nairobi, Kenya Colony, (from "*Cricetomys sp.*") ].

*Comparison*.—The present species, which is known from both sexes, is a member of the *Talpoides* Group.

The female of *vosseleri*, as well as that of the other forms of the *Talpoides* Group and those of the *Advectus* Group, is separable from the members of the *Hansen* and *Vicinus* Groups by having the ultimate tergite trigonally or trapezoidally produced instead of being broadly transverse. The female of the present form, and those of the rest of the *Talpoides* Group, are separable from that sex of the members of the *Advectus* Group by the distal portion of the ultimate sternite possessing a definite submarginal carina and a submarginal channel or impression, while the members of the latter group have the distal portion of the ultimate sternite of the female deplanate, or with at most a slight distal cingulation. From the other females of the *Talpoides* Group *vosseleri* is separated by the ventral surface of the ultimate tergite being concave mesad, while in the latter this surface is deplanate to but slightly convex.



The male of *vosseleri* and that sex of the other known forms of the Talpoides Group, differ from those of the Hanseni and Advectus Groups by having the process of the ultimate sternite directed sinistrad instead of dextrad, while the median portion of the distal margin of the penultimate tergite is usually truncate, occasionally shallowly concave, as opposed to those of the other species groups which have this margin usually produced or rarely truncate. The male of this species differs from that of *talpoides*, and agrees with that of *deceptus*, in having the ultimate tergite transverse instead of semicircular. From the male of *deceptus* the present form differs by having the ultimate tergite with its greatest length equal to one-fourth of proximal or one-half of apical width, and the process of the ultimate sternite with the dorsal margin evenly arcuate, as opposed to *deceptus* which has the median length equal to one-half the proximal or three-fifths the apical width and the process of the ultimate sternite with an apical lobe on the dorsal margin.

*Type*. — ♀; Amani, Usambara, Tanganyika Territory. August, 1927. (C. B. Williams; "from *Cricetomys* sp.") [Academy of Natural Sciences of Philadelphia, Type no. 5544.]

As in the other species of this genus the only specific diagnostic features are in the terminal abdominal segments.

Penultimate tergite transverse, greatest length equal to approximately one-half of proximal width; lateral margins rather strongly sigmoid, particularly above the cercal insertions, passing by a distinct obtuse-angulation into the slightly produced distal portion, which has a distinct obtuse-angulation on the median line. In lateral view the axes of the penultimate and ultimate tergites are in essentially the same plane.

Ultimate tergite, when viewed from the dorsum, trigonal, greatest proximal width equal to approximately twice median length; lateral portions of the margin evenly convergent caudad to the rather broadly arcuate apex; ventral surface concave mesad, margin of this concavity armed with short, heavy, spaced chaetae, the concavity itself sparsely supplied with short, heavy chaetae.

Ultimate sternite transverse, semicircular, median production with greatest length equal to approximately one-half of proximal width, true margin evenly rounded; submarginal carina prominent, approximating true margin at median line and more closely so at lateral bases where they are practically coalesced, lateral portions of submarginal carina oblique, sub-arcuate, convergent to the obtuse-angulation on the median line,<sup>24</sup> infra-marginal sulciform channel strongly indicated laterad but narrowly obsolete mesad; proximo-lateral sulciform impressions unevenly developed, sinistral weak, scarcely noticeable, dextral narrow and shallow, slightly broader proximad than caudad, surrounding area much darker in color than any other portion of the sternite.

Cerci as in the other members of this genus.

<sup>24</sup> When seen in ventral aspect the lack of concentric concordance of this margin with the true margin of the sternite is clearly evident.

*Allotype*.— $\delta$ ; same data as type, except July, 1927 instead of August, 1927. [Hebard Collection.]

The male sex of this species differs from the female sex, as with the others of the genus, solely in the features of the terminal abdominal segments.

Penultimate tergite transverse, roughly symmetrically trapeziform, greatest width (proximal) equal to approximately twice greatest length; lateral margins subparallel for about one-third the tergite's length, then evenly oblique convergent caudad, roundly passing into the truncate distal portion, this truncate portion being equal to somewhat more than one-half the proximal width. In lateral aspect the dorsal lines of the penultimate and ultimate tergites are seen to be in practically the same plane.

Ultimate tergite, when viewed from the dorsum, strongly transverse, greatest length equal to about one-fourth of proximal or one-half of apical width; lateral portions of margin evenly arcuate convergent, roundly passing into the truncate distal section.

Ultimate sternite slightly asymmetrical but as a whole trigonal produced mesad, greatest length, exclusive of median cultriform production, equal to approximately two-thirds the greatest width, which is at the base of the produced area; sinistral margin of production weakly concave, dextral faintly sigmoid, both portions converging slightly dextrad of the median line to form the cultriform production which is directed sinistrad; the production curved ventro-sinistrad, moderately compressed, with its peduncle ovate in section, arcuate longitudinally, all of the process distad of the peduncle compressed, in lateral view much resembling a meat cleaver, immediate apex very narrowly rounded, (see Figure 39), its ventral outline distad of the proximal shoulder faintly concave, its length in lateral aspect equal to approximately one-fifth the greatest width of the sternite.

Cerci as in the female and other members of the genus.

Parameres; for illustration of these appendages see Figure 45.

*Paratypic series*.—We have indicated as paratypes eleven females and three males. Five of these females are from Mt. Mbololo,<sup>25</sup> Teita District, Kenya Colony, and were taken from *Cricetomys gambianus enguvi* on November 8, 1911, by E. Heller, of which three are in the collection of the United States National Museum and two in the Hebard Collection; while five females and one male are from Amani, Usambara, Tanganyika Territory, taken on *Cricetomys* sp., two of these females collected by C. B. Williams in July 1927, belonging to the United States National Museum, one male and two females similarly collected but on August 21, 1927, belonging to Cambridge University Museum, and the other, also taken by C. B. Williams, August 1927, belonging to the Academy of Natural Sciences of Philadelphia. The other paratypes are a male and two females taken by E. Heller on *Cricetomys* sp. in Kenya Colony ("British East Africa"),

<sup>25</sup> Mt. Mbololo, the summit of which is said to reach 4400 feet, is in the Teita Hills about midway between Kilimanjaro and the coast. The name is sometimes written Mbululu, or Umbololo.

while on the Rainey African Expedition in 1911, belonging to the United States National Museum.

*Variation.*—In this series of females there is some slight variation in the characters mentioned in the description of the type. Due to the method of preservation the penultimate tergite is often retracted.<sup>26</sup> The lateral margins of this tergite are sigmoid but vary in the exact character of this flexure. In certain of these specimens there is no appreciable angulation between the lateral margin and the distal margin of this tergite, and the margin as a whole appears broadly rounded. The ultimate tergite has the form of the immediate apex varying from narrowly to broadly rounded. The number of chaetae on the ventral surface of this tergite varies individually. In alcoholic material this surface is always concave, but not as prominently so as in dry material. The ultimate sternite shows very little variation except in the proximo-lateral sulciform impressions, of which the sinistral is always quite faint, while the dextral is always more prominent but quite variable in extent, the latter impression occasionally split to some degree in its distal portion. One of the females from Mt. Mbololo has been injured, several of the abdominal tergites have portions of their surface cut away, the ultimate tergite is badly distorted, and both cerci have been broken near their bases. However, all of these injuries have healed and it seems probable to us that they were caused by the claws of the host rat.

The three male paratypes agree in all essential respects with the allotype.

*Measurements (in millimeters) of representative individuals of  
Hemimerus vosseleri*

	Length of body (exclusive of cerci)	Median length of entire thorax	Greatest width of mesonotum
♀, Amani, Tanganyika Terr., <i>type</i> . . . . . (dry)	13.	3.8	3.8
♀, Amani, Tanganyika Terr., <i>paratype</i> . . . (dry)	13.8	5.9 <sup>27</sup>	5.1 <sup>27</sup>
♀, Mt. Mbololo, Kenya Colony, <i>paratype</i> . (dry)	12.2	3.8	3.8
♀, Mt. Mbololo, Kenya Colony, <i>paratype</i> . (dry)	12.6	3.9+	3.8
♀, Mt. Mbololo, Kenya Colony, <i>paratype</i> . (alc.)	13.+	5.5	4.7
♀, Kenya Colony, <i>paratype</i> . . . . . (dry)	12.8	4.1	3.8
♂, Amani, Tanganyika Terr., <i>allotype</i> . . . (dry)	— <sup>28</sup>	3.7	4.1
♂, Kenya Colony, <i>paratype</i> . . . . . (dry)	11.	4.8	4.9

*Distribution.*—Known from the Usambara Mountain region of Tanganyika Territory and the Teita Hills District of adjacent extreme southern Kenya Colony. Whether this species is distributed to the north and south

<sup>26</sup> This condition, due to the method of preservation of the material, has been discussed more fully under *H. hanseni*.

<sup>27</sup> This specimen has been somewhat flattened.

<sup>28</sup> This specimen lacks the head.

of the areas here given remains to be determined. The record of a specimen of *Hemimerus* from Nairobi,<sup>29</sup> Kenya Colony, may refer to the present species, but this can be determined solely by examination of material from that area.

*Host association*.—The majority of the previously reported specimens that are referable to this species were said to have been taken from either *Cricetomys gambianus* or an unidentified form of that genus. Most of the material here recorded does not have with it the specific identity of the host rat, but the series from Mt. Mbololo are from the type series of *Cricetomys gambianus enguvi* Heller. It is from this scant information that we draw our conclusions that this species will, in all probability, be found solely on *C. g. enguvi* or very closely related forms.

*Specimens examined*.—20; 12 ♀, 2 juv. ♀, 4 ♂, 2 juv. ♂.

Amani, Usambara, Tanganyika Territory; Aug. 1927; (C. B. Williams; "from *Cricetomys sp.*"); 2 ♀ (1 ♀ alc., 1 ♀ dry), 1 juv. ♂, (*type and paratype*): August 21, 1927; (C. B. Williams; "on rat *Cricetomys*"); 1 ♀ (alc.), 1 juv. ♀ (alc.), 2 ♂ (alc.); [Cambridge Univ. Mus.]: July 1927; (C. B. Williams; "from *Cricetomys sp.*"); 1 ♂, (*allotype*); [Hebard Cln.]: 2 ♀, 1 juv. ♀, 1 juv. ♂, (*paratypes*); [U.S.N.M.].

Mt. Mbololo, Teita District, Kenya Colony; November 8, 1911; (E. Heller, "on *Cricetomys gambianus enguvi*"); 2 ♀ (*paratypes*); [Hebard Cln.]: 3 ♀ (1 ♀ alc., 2 ♀ dry), (*paratypes*); [U.S.N.M.].

Kenya Colony ("British East Africa"); (Rainey African Expedition, 1911; E. Heller; "on *Cricetomys sp.*"); 2 ♀, 1 ♂, (*paratypes*); [U.S.N.M.].

***Hemimerus sessor***, new species. Figs. 3, 12 and 23.

This species, known only from the female sex, is a member of the *Talpoides* Group. It is more nearly related to *deceptus* than it is to the other members of that assemblage.

*Comparison*.—The female of this species, as well as that sex of the other members of the *Talpoides* Group and those of the *Advectus* Group, is separable from the members of the *Hanseni* and *Vicinus* Groups by having the ultimate tergite trigonally produced, instead of being broadly transverse. The females of the present species and the others of this species group (*vosseleri*, *deceptus* and *talpoides*) are separable from the members of the *Advectus* Group by having a distinct submarginal carina, and a submarginal sulciform impression on the distal portion of the ultimate sternite while the members of the *Advectus* Group completely lack this, having at most a slight distal cingulation. In this sex *sessor* agrees with *talpoides* and *deceptus* in having the normally exposed ventral surface of the ultimate tergite convex or deplanate, as opposed to concave in *vosseleri*. The female

<sup>29</sup> *Vide supra*.

of *essor* differs from the remaining members of the *Talpoides* Group by having the margin of the production of the ultimate sternite evenly rounded, neither flattened mesad (*talpoides*) nor semi-ovate produced (*deceptus*), the submarginal carina having the same general form as the actual margin, being concentric with it.

The male of this species is not known.

*Type*.—♀; Mt. Gargues,<sup>30</sup> British East Africa, present Kenya Colony. August 31, 1911. (Rainey African Expedition 1911, E. Heller: from type of *Cricetomys gambianus raineyi* Heller). [United States National Museum.]

The present species, which is known only from the female sex, is very similar to the other species of this group, differing solely in the features of the terminal abdominal segments.

Penultimate tergite in general form transverse, roughly trigonal, greatest median length slightly less than one-half the proximal width; lateral margins convergent, weakly sigmoid, roundly passing into the arcuate distal portion. In lateral view the dorsal lines of the penultimate and ultimate tergites are in but slightly different planes, the ultimate tergite very slightly sub-arcuately deflexed ventro-caudad.

Ultimate tergite, when viewed from the dorsum, subtrigonally produced, median length equal to one-half greatest visible (proximal) width; lateral portion of margin gradually and weakly arcuate convergent to the rather narrowly but evenly subangulate apex; ventral surface of ultimate tergite deplanate,<sup>31</sup> apically armed with rather long chaetae, this surface having the usual excavate seat or flange so that the distal portion of the ultimate sternite may be locked shut.

Ultimate sternite transverse, median production low, evenly rounded, greatest length equal to approximately one-half of greatest width; actual margin regularly rounded, submarginal carina approaching it most closely at the lateral bases, this carina evenly rounded and practically concentric with the margin from which it is separated by an impressed subsulciform

<sup>30</sup> This locality is in the Mathews Range, north of Mt. Kenya and southeast of Lake Rudolf. Approximate position 0° 56' N., 37° 28' E. The summit is given on the Kenya section of the International Map as reaching an elevation of 2690 meters. The name is also written Uaragess and Baragues (so given on the International Map). Mr. Heller, who collected the types of this species writes us as follows regarding the type locality:

"Mount Gargues is an isolated mountain situated in the thorn-bush desert of the Abyssinian border of Kenya, British East Africa. Its summit attains an altitude of approximately eight thousand feet, and is subject to fog and a fair rain-fall. It is heavily clothed by forest trees and bush of many species, but its lower slopes are dry and support only the cactus-like trees known as candelabras (*Euphorbia*) and several thorn-trees of the genus *Acacia*—wait-a-bit; also thorn bushes and sanseverias. No running streams occur on Mount Gargues, and water is found only in a few springs and water-holes. The giant rats (*Cricetomys*) occur in the forest, and live in burrows in the ground. Their chief enemies, no doubt, are the various species of mongooses which are not rare in this district."

<sup>31</sup> In the type and in other dry material this surface is covered with what appear to be transverse rugae; however, in alcoholic material this surface is perfectly smooth. The condition of the dry material may be due to dessication.

channel, such as occurs in the other members of the *Talpoides* Group; the proximo-lateral sulciform impressions extend but about one-half the distance to the evident base of the sternite, dextral one more prominent, more deeply and broadly excavate, broader proximad than caudad.

Cerci as in other members of the genus.

*Variation*.—The other specimens of this species which have been examined agree in all important respects with the type, except for the one detail mentioned above.

*Measurements (in millimeters) of Hemimerus sessor*

	Length of body (exclusive of cerci)	Median length of entire thorax	Greatest width of mesonotum
♀, Mt. Gargues, Kenya Colony, <i>type</i> . . . (dry)	11.5	4.9	4.7
♀, Mt. Gargues, Kenya Colony, <i>paratype</i> . (dry)	11.2	4.6	3.8
♀, Mt. Gargues, Kenya Colony, <i>paratype</i> . (dry)	11.6	3.9	3.9
♀, Mt. Gargues, Kenya Colony, <i>paratype</i> . (alc.)	13.	5.3	5.1

*Distribution*.—This species is known only from the type locality, so we are unable to say anything further concerning its distribution.

*Host association*.—The type of this species as well as the paratypes were taken from the type specimen of *Cricetomys gambianus raineyi* Heller, and it seems probable to us that this species will be found only on that form of the host rats.

*Paratypic series*.—Three females with the same data as the type (Mt. Gargues, "British East Africa"; August 31, 1911; (Rainey African Expedition 1911, E. Heller; from type of *Cricetomys gambianus raineyi* Heller).

*Specimens examined*.—4 ♀, mentioned above (3 ♀ dry, 1 ♀ alc.), [U.S. N.M.].

***Hemimerus deceptus***, new species. Figs. 4, 13, 25, 31, 37 and 43.

This species, which is known from both sexes, is a member of the *Talpoides* Group.

*Comparison*.—The female of this species and that of the rest of the members of the *Talpoides* Group, as well as those of the *Advectus* Group, differ from those of the *Hanseni* and *Vicinus* Groups by having the ultimate tergite trapezoidally or trigonally produced instead of broadly transverse. This species and the rest of those of the *Talpoides* Group differ collectively from the members of the *Advectus* Group in having a well marked submarginal carina and a submarginal sulciform impression on the ultimate sternite, while the latter have at most only a slight distal cingulation. The female of *deceptus* differs from that sex of *vosseleri* in the ventral surface of the ultimate tergite being deplanate to weakly convex instead of concave. This species is separable from the remaining members of the *Talpoides* Group by the shape of the production of the ultimate sternite; in *talpoides*

this production is flattened mesad, in *essor* it is evenly arcuate, semicircular and with the submarginal impression practically concentric with the actual margin, but in *deceptus* this area is semi-ovate produced and the submarginal impression is subobtusely arcuate, not following the curvature of the margin itself and in consequence not concentric with it, furthest from the distal margin at the median line and at the lateral bases subcontiguous with the margin.

The male of the present species and those of *vosseleri* and *talpoides* differ from that sex of the other forms by having the process of the ultimate sternite directed sinistrad instead of dextrad. The male of *deceptus* differs from that of *talpoides* by having the ultimate tergite transverse instead of semicircular. From the male of *vosseleri* the present species may be separated by its having the distal margin of the penultimate tergite shallowly concave, and the process of the ultimate sternite with an apical lobe on its dorsal margin, as opposed to *vosseleri* with the distal margin of the penultimate tergite truncate and the dorsal margin of the process of the ultimate sternite evenly arcuate.

*Type*.—♀; National Zoological Garden, Pretoria, Transvaal, South Africa.<sup>32</sup> (G. A. Bedford.) [British Museum of Natural History.]

Head, thorax and other features, except the terminal abdominal segments, as in the other members of this genus.

Penultimate tergite in general form transverse, subtrigonal, greatest exposed median length being equal to slightly less than one-half of evident proximal width; distal margin evenly curved<sup>33</sup> to the rounded subobtusely-angulate midpoint. In lateral aspect, the dorsal lines of the penultimate and ultimate tergites are seen to be respectively in different planes, the two together forming a low rounded obtuse-angulation..

Ultimate tergite in general form longitudinally subconical except for the subdeplanate to weakly convex character of the ventral surface of the same; as seen in dorsal aspect, general form produced, acute-trigonal; lateral portions of the margin nearly straight convergent caudad to a rounded acute apex; vicinity of lateral margins of the ventral surface supplied with numerous short, spaced chaetae.

Ultimate sternite with median production semi-ovate; greatest length of production to its greatest width as 3 is to 4; the distinctly excavate submarginal sulciform impression follows the entire curve of the median production and broadly separates from the true margin of the sternite the supplementary submarginal carina or ledge, the latter, however, in shape

<sup>32</sup> Through the kindness of Dr. Rudolph Bigalke, Director of the National Zoological Garden of South Africa, we have been informed that the host rat of this specimen, which was called *Cricetomys gambianus*, came from the Transvaal.

This specimen was selected as type and figured before the additional material with much more complete data discussed below was obtained for study.

<sup>33</sup> Due to drying, the lateral portions of the distal margin in the type have, in part, decurved sufficiently to give to the general outline, in dorsal view, a trigonal form. What has happened is evident from the condition of the type specimen and paratypes.

being subobtusely-angulate and not concentric with the true margin of the sternite, from which it is appreciably separated on the medio-longitudinal line, although at its lateral bases they are much less distant; proximolateral sulciform impressions oblique divergent proximad, extending virtually to the base of sternite, sinistral more weakly developed, dextral throughout slightly broader and more excavate and split back (proximad) toward the base of the sternite.<sup>34</sup>

Cerci as in other members of this genus.

*Allotype*.—♂; Gobler's Farm, Zoutpansberg District, North Transvaal. June 28, 1935. (A. G. White; from *Cricetomys gambianus haagneri* Roberts.) [Transvaal Museum.]

The terminal abdominal segments of this species, as in the other members of this genus, contain the only specific characters.

Penultimate tergite broadly transverse, apical width equal to twice the greatest median length, or greatest visible (proximal) width slightly less than three times the greatest length; lateral margins evenly but slightly convergent caudad, passing roundly into the shallowly concave distal margin. Penultimate and ultimate tergites with their axes in practically the same plane, the dorsal line of the ultimate tergite slightly deflexed ventro-caudad.

Ultimate tergite transverse, in general form roughly symmetrically trapezoidal, median length equal to three-fifths of apical width, or greatest width (proximal) equal to slightly more than twice median length; lateral portions of margin evenly arcuato-convergent, roundly passing into the subtruncate median portion, the rounded corners supplied with long rather heavy setae.

Ultimate sternite slightly asymmetrically but basically subtrigonally produced, greatest length, exclusive of production, equal to slightly less than one-half of greatest (proximal) width; dextral portion of distal margin strongly and evenly sigmoid, sinistral portion more weakly and less evenly sigmoid; production extending sinistro-caudad, length, in lateral aspect, equal to approximately one-fourth that of the sternite (exclusive of production); peduncle long, equal to slightly less than one-half the total length of the production, ovate in section, with a small, well-marked shoulder on the ventral surface, then slightly concave to apex, dorsal margin evenly arcuate for approximately two-thirds the total length, then with a well-marked rounded shoulder continuing evenly arcuate to the narrowly rounded acute apex.

Cerci as in all the other members of the genus.

Parameres; for illustration of these appendages see Figure 43.

*Paratyptic series*.—We have indicated as paratypes forty females and seventeen males. One of these females is from the National Zoological Garden, Pretoria, Transvaal, South Africa, and the rest of the series of this sex and all of the males are from Gobler's Farm, Zoutpansberg District,

<sup>34</sup> As seen from material of several forms there appears to be a definite structural weakness along this dextral impression, as in many specimens it is split to a greater or lesser degree.



North Transvaal, and were taken by A. G. White, on June 28, 1935, from a female of *Cricetomys gambianus haagneri* Roberts.

*Variation*.—This reasonably large series shows but little variation in any of the specific characters. However, in the female the ventro-lateral margins of the ultimate tergite are supplied with a varying number of spaced, heavy setae and occasionally there are a few, short setae on the median portion of the ventral surface of the ultimate tergite. The distal margin of the penultimate tergite varies from subarcuato-truncate to subobtusely produced. The ultimate tergite, in lateral view, rarely appears subrostrate produced. The proximo-lateral sulciform impressions are quite variable in their extent and prominence, the dextral always broader and more deeply excavate than the sinistral. One of the females has one of the cerci perfectly formed but only about one-third the usual length, and it seems probable to us that this is due to regeneration.

The males of this species show no important variation. The only variation noticed in the series is the slight difference in the absolute direction of the process of the ultimate sternite.

*Measurements (in millimeters) of representative individuals of  
Hemimerus deceptus*

		Length of body (exclusive of cerci)	Median length of entire thorax	Greatest width of mesonotum
♀, National Zoological Garden, Pretoria, type .....	(dry)	11.	3.8	3.3
♀, Gobler's Farm, North Transvaal, paratype .....	(dry)	10.8	3.2	3.6
♀, Gobler's Farm, North Transvaal, paratype .....	(dry)	10.7	3.8	3.5
♀, Gobler's Farm, North Transvaal, paratype .....	(dry)	10.4	3.8	3.7
♀, Gobler's Farm, North Transvaal, paratype .....	(dry)	10.5	4.	3.6
♀, Gobler's Farm, North Transvaal, paratype .....	(dry)	10.5	3.9	3.6
♀, Gobler's Farm, North Transvaal, paratype .....	(alc.)	10.3	4.	3.8
♀, Gobler's Farm, North Transvaal, paratype .....	(alc.)	10.2	4.2	4.
♀, Gobler's Farm, North Transvaal, paratype .....	(alc.)	10.7	4.1	4.
♀, Gobler's Farm, North Transvaal, paratype .....	(alc.)	11.	3.9	3.8
♀, Gobler's Farm, North Transvaal, paratype .....	(alc.)	11.5	3.8	3.8
♀, Gobler's Farm, North Transvaal, paratype .....	(alc.)	11.5	3.8	3.6
♂, Gobler's Farm, North Transvaal, allotype .....	(alc.)	9.8	3.8	3.2
♂, Gobler's Farm, North Transvaal, paratype .....	(dry)	10.	3.6	3.5

♂, Gobler's Farm, North Transvaal, paratype .....	(dry)	10.2	3.8	3.8
♂, Gobler's Farm, North Transvaal, paratype .....	(dry)	10.	3.8	3.6
♂, Gobler's Farm, North Transvaal, paratype .....	(alc.)	10.2	3.8	3.3
♂, Gobler's Farm, North Transvaal, paratype .....	(alc.)	10.3	3.8	3.2
♂, Gobler's Farm, North Transvaal, paratype .....	(alc.)	10.	3.8	3.4
♂, Gobler's Farm, North Transvaal, paratype .....	(alc.)	9.8	3.8	3.5

*Distribution.*—The only definite record of the capture of this species is the series from Gobler's Farm, North Transvaal. The other two specimens from the National Zoological Garden, Pretoria, Transvaal, are known to have been taken from a host rat that was captured in the Transvaal.

*Host association.*—The sole definite record of the subspecific host of this species is that of the series from Gobler's Farm, North Transvaal, which was taken from a female of *Cricetomys gambianus haagneri* Roberts. The other two specimens were taken from a subspecifically unidentified host rat.

*Specimens examined.*—100: 41 ♀, 22 juv. ♀, 18 ♂, 17 juv. ♂, 2 juv. sex uncertain.

National Zoological Garden, Pretoria, Transvaal, South Africa; (G. A. Bedford); 2 ♀ (*type* and *paratype*); [B.M.N.H.].

Gobler's Farm, North Transvaal; June 28, 1935; (A. G. White, "from *Cricetomys gambianus haagneri* Roberts"); 39 ♀ (25 ♀ alc., 14 ♀ dry); 22 juv. ♀ (alc.); 18 ♂ (12 ♂ alc., 5 ♂ dry); 17 juv. ♂ (alc.); 2 juv. sex uncertain (alc.), (*allotype* and *paratypes*); [Transvaal Museum].

**Hemimerus talpoides** Walker. Figs. 5, 14, 20, 26, 32, 38 and 44.

*Hemimerus talpoides* Walker, Catal. Derm. Salt. Brit. Mus., V, Suppl. p. 2, (1871), ["♂" (some now known to be females); Sierra Leone and "West Africa"].—Saussure, Mém. Soc. Hist. Nat. Genève, XXVI, p. 414, (1879), [♂; Sierra Leone].—Sharp, Cambr. Nat. Hist., V, p. 218, fig. 117, (1895).—Bormans and Krauss, Das Tierreich, Lief. 11, Orth., Forficulidae und Hemimeridae, p. 132, (in part), (1900).—Kirby, Syn. Cat. Orth., I, p. 59, (1904).—Bouvier, Bull. Ent. Soc. France, LXXIV, p. 174, (1905), [Timbo (Fouta-Djalou), and Lower Casamance (foret des Bayottes), (on "*Cricetomys gambianus*")].—Carpenter, Ent. Month. Mag., XLV, p. 256, pl. IV, figs. 1-4, (1909), [♀; Sierra Leone].—Burr, Genera Insect., fasc. 122, p. 8, (in part), (1911).—Chopard, Arch. Mus. Nation. Hist. Nat. Paris, (6), XII, part 2, pp. 443, 444, figs. 10, 14, 17, 21, 24, 25, 26, (1935), [♀; Kindia, French Guinea, (on "*Cricetomys gambianus*")]; ♂, ♀, juv.; Lower Casamance, Toubou-Bagné, Baynouko, Portuguese Guinea, (on "*Cricetomys gambianus*")]; ♂, ♀, juv.; Fouta-Djalou, Timbo, (on "*Cricetomys gambianus*")].

*Hemimerus* sp. Cook, Proc. Ent. Soc. Wash., IV, p. 53, (1901), [Liberia, (not on *Cricetomys* but under rotting wood)].

*Hemimerus chevalieri* Chopard, Bull. Soc. Ent. France, XXXIX, no. 17, p. 242, (1934), [♂, ♀; Ivory Coast].—Chopard, Arch. Mus. Nation. Hist. Nat. Paris, (6), XII, part 2, pp. 443, 444, figs. 13, 20, (1935), [♂, ♀, juv.; Ivory Coast].

*Original material.*—One of the original Walkerian specimens from Sierra Leone, in the British Museum of Natural History, has been designated as

the lectotype. This specimen is a female and has been labeled "type". We now know that the original material of *H. talpoides* was composed of both sexes, that still remaining in the British Museum of Natural History collection having been examined by the senior author in December, 1934. Evidently Walker's material was composed of two females, two males and one immature individual, one of the two females being the specimen labeled "West Africa".

*Synonymy.*—Chopard's *H. chevalieri* was supposed to be separable from *talpoides* in having more elongate and slender antennal articles, the process of the male ultimate sternite more strongly curved dextrad, and the ultimate tergite and sternite of the female of somewhat different outline. We have shown under *H. hansenii* the variation to be found in the proportions of individual antennal articles in a single species, due to methods of preparation, which we feel fully explains the supposed difference in this respect. Similarly, as discussed under *H. deceptus*, the degree of curvature of the process of the ultimate sternite of the male varies appreciably within specific limits, and as shown below in the specific characters of this species the exact form of the ultimate sternite of the female exhibits a range embracing the supposed difference of *chevalieri*. In consequence we consider the latter to be a synonym of *talpoides*.

*Comparison.*—Under the name *talpoides* will be found literature relating to most of the species of the genus here recognized, clearly due to Hansen's failure to appreciate the specific distinction of the material studied by him, and on which Sharp later placed the name *hansenii*. Other workers almost without exception used the oldest specific name given to any form of the genus, i.e. *talpoides*, for their comments relating to these interesting insects.

The female sex of *talpoides* as well as that of the other members of the Talpoides Group and also those of the Adveetus Group are readily separable from the members of the Hansenii and Vicinus Groups by having the ultimate tergite subtrigonally or trapezoidally produced, instead of broadly transverse. The female of this species and of the other members of the Talpoides Group, differ from that sex of the members of the Adveetus Group by having a submarginal carina and a submarginal impression or channel on the distal portion of the ultimate sternite, instead of that portion of the sternite being smooth or with a slight distal cingulation. The female of *talpoides* is separable from that of *vosseleri* by the former having the ventral surface of the ultimate tergite either deplanate or convex, instead of this surface being concave mesad. From females of the other members of the Talpoides Group that of true *talpoides* is separable by having the production of the ultimate sternite distinctly and the submarginal impression usually flattened mesad, as opposed to *deceptus* which has these areas semi-ovate, or *essor* which has them evenly arcuate, semicircular.

The male of this species differs from that sex of *advectus*, *hanseni* and *bouvieri* by having the process of the ultimate sternite directed sinistrad instead of dextrad. From the males of *vosseleri* and *deceptus*, that of *talpoides* differs in having the ultimate tergite semicircular instead of transverse, and the process of the ultimate sternite, in lateral view, is more or less claw-like without a well-marked peduncle, instead of with a definitely differentiated one.

*Specific characters.*<sup>35</sup>—As in all the other members of this genus the only specific characters are in features of the terminal abdominal segments.

*Female.*—Penultimate tergite of the female in general form roughly transverse trigonal, greatest median length contained twice in greatest visible (proximal) width; lateral convergent portions of the margin sub-arcuate, passing into the obtuse-arcuate distal portion. Dorsal outline of penultimate and ultimate tergites, in lateral view, rounded obtuse-angulate, the latter tergite slightly deflexed disto-ventrad.

Ultimate tergite, when viewed from the dorsum, in general form trigonal, greatest evident length slightly less than proximal width; lateral portions of the margin gradually and evenly convergent, weakly arcuate; apex narrowly rounded, acute-angulate; in lateral view, appreciably rostrate, the dorsal line subconcave to subconvex;<sup>36</sup> ventral surface of this tergite weakly convex, ventral margins supplies with spaced, short, heavy setae.

Ultimate sternite transverse, median production strongly transverse, usually flattened mesad, occasionally regularly arcuate; varying in certain individuals to a condition in which the production is transverse truncate, involving even more than one-half of the greatest width of the production, in the more arcuate type the width of the production is slightly more than three times its greatest length; distal portion of this sternite with a distinct submarginal carina, when viewed laterally, or from caudal aspect, thickened and bearing a distinct and deep channel-like sulcation which reaches across the full width of the production, the border of the sternite thus having two distinct subcarinate edges<sup>37</sup> which when seen in ventral aspect are almost equal in outline, the ventral one occasionally less ample and less completely masking the dorsal one; proximo-lateral sulciform impressions usually weakly developed and sometimes scarcely noticeable, or quite evident, but never extending far toward the base of the sternite, dextral impression sometimes more clearly defined than sinistral and occasionally slightly split.

Cerci as in the other members of the genus.

*Male.*—The male sex of this species differs from the female, and also from the other members of the genus, solely in the characters of the terminal abdominal segments.

Penultimate tergite, of the male, transverse, symmetrically trapezoidal; lateral margins evenly converging, passing by an obtuse angulation into the truncate or shallowly concave median section.

<sup>35</sup> These descriptions are based mainly upon two specimens, one a female from Sierra Leone, and the other a male from Freetown, Sierra Leone.

<sup>36</sup> This variation, as found in a series of seven females, is probably due to drying.

<sup>37</sup> The more ventral of which is homologous with what we are calling the submarginal carina.

Ultimate tergite semicircular in outline, greatest exposed median length equal to slightly more than one-third of proximal width, distal width slightly greater than proximal width; when viewed laterally its dorsal line is in almost the same plane as that of the penultimate tergite; ventro-lateral margins armed with a few spaced chaetae; ventral surface of tergite weakly convex.

Ultimate sternite in general form transverse, weakly asymmetrical; the distal production roughly broad-trigonal, median length slightly less than one-half of greatest width, sinistral portion of distal margin shallowly concave, dextral portion of same faintly sigmoid, immediate apex produced into a claw-like, arcuately decurved production which in profile shows almost no peduncular narrowing and, while compressed most of its length, with no extensive lamellation of its ventral surface, as seen in ventral aspect the axis of the production is directed slightly sinistrad.

Cerci as in the other members of the genus.

Parameres; for illustration of these appendages see Figure 44.

*Variation.*—There is no important variation in any of the specific features which has not been discussed under the specific characters.

*Measurements (in millimeters) of representative individuals of  
Hemimerus talpoides*

	Length of body (exclusive of cerci)	Median length of entire thorax	Greatest width of mesonotum
♀, Obuasi Ashanti, Gold Coast ..... (dry)	10.	3.8	3.8
♀, Obuasi Ashanti, Gold Coast ..... (dry)	11.	3.9	3.7
♀, Accra, Gold Coast ..... (dry)	11.	3.5	3.7
♀, Accra, Gold Coast ..... (dry)	9.8	3.4	3.7
♀, Portuguese Guinea ..... (dry)	9.	3.6	3.4 <sup>38</sup>
♀, Port Lokko, Sierra Leone ..... (dry)	9.5	3.6	3.3 <sup>38</sup>
♀, Sierra Leone ..... (dry)	10.5	3.6	3.8
♂, Accra, Gold Coast ..... (dry)	10.5	3.5	3.6
♂, Sierra Leone ..... (dry)	9.5	3.6	3.7

*Distribution.*—From French Guinea (Lower Casamance) through Portuguese Guinea, Sierra Leone, Liberia, Ivory Coast, Gold Coast to coastal southwestern Nigeria. The species appears to be limited in distribution to the Upper Guinea Forest District and at least portions of the adjoining Upper Guinea Savanna District, both divisions of the West African Sub-region. For a full discussion of the faunal areas of Africa see Chapin's masterly treatise introductory to his "Birds of the Belgian Congo".<sup>39</sup>

*Host association.*—Many of the specimens of this species previously reported were said to have been taken from *Cricetomys gambianus*, while some of the material here reported, i.e. that from Accra, Gold Coast and a portion of the Sierra Leone material, is labelled as from the same host.

<sup>38</sup> The sides of the thorax are exceptionally decurved.

<sup>39</sup> Bull. Amer. Mus. Nat. Hist., LXV, pp. 82-98, figs. 18-19, (1932).

It is our belief that the host of this species is the true *Cricetomys gambianus*, although we were not able to examine any of the host rats from which this material was taken.

*Specimens examined*.<sup>40</sup>—11; 7 ♀, 1 juv. ♀, 2 ♂, 1 juv. ♂

Portuguese Guinea; May 30, 1909; ("off *Cricetomys*"); 1 ♀; [B.M.N.H.].

Port Lokko, Sierra Leone; November 11, 1912; (J. J. Simpson; "off bush rat"); 1 ♀; [B.M.N.H.].

Leicester, Freetown, Sierra Leone; October 17, 1899; (E. E. Austin, "from rat known as 'ground pig'"); 1 ♂; [B.M.N.H.].

Freetown, Sierra Leone; November 17, 1899; (E. E. Austin, "from rat known as 'ground pig'"); 1 juv. ♀; [Hebard Cln.].

Sierra Leone; 1904; (Major Smith; "from *Cricetomys gambianus* found dead in the brush"); 1 ♀; [B.M.N.H.].

Obuasi, Ashanti, Gold Coast; July 16, 1907; (W. M. Graham, "caught on pig's feet"); 2 ♀; [B.M.N.H.].

Accra, Gold Coast; 1919; (Dr. A. Ingram; from *Cricetomys gambianus*"); 1 ♂; [B.M.N.H.].

Near Lagos, Nigeria; (W. P. Lowe); 1 juv. ♂; [B.M.N.H.].

*Hemimerus bouvieri* Chopard. Figs. 7, 16, 22, 28, 34, 40 and 46.

*Hemimerus talpoides* Bouvier (not *Hemimerus talpoides* Walker), Bull. Soc. Ent. France, LXXV, p. 170, (1906), [Guengère, Valley of Pungwe River, Mozambique].

*Hemimerus bouvieri* Chopard, Bull. Soc. Ent. France, XXXIX, no. 17, p. 242, (1934), 1 ♂; Cuengere (i.e. Guengère), Valley of Pungwe River, Mozambique.—Chopard, Rev. Zool. Bot. Afr., XXVI, fasc. 1, p. 121, figs. 1 and 2, (1934), 1 ♂, ♀; Dilolo, Lulua District, Belg. Congo (on "*Cricetomys emini*"); ♀; Kitega, Urundi, (on "*Cricetomys emini*"); ♀; Kambove, Katanga, (on "*Cricetomys emini*")].—Chopard, Arch. Mus. Nation. Hist. Nat. Paris, (6), XII, part 2, pp. 443, 444, figs. 1, 15, 16, 23, (1935).

This species, which was recently described by Dr. Chopard, is a member of the *Advectus* Group.

*Comparison*.—The female sex of this species and of the other member of this species group (*advectus*), as well as the members of the *Talpoides* Group, differ from that sex of the members of the *Hanseni* and *Vicinus*

<sup>40</sup> Besides Walker's original material and that here listed there are in the British Museum of Natural History the following specimens which were there examined by the senior author in 1934:

Portuguese Guinea; May 30, 1909; ("off *Cricetomys*"); 1 ♀.

Freetown, Sierra Leone; November 17 and 21, 1899; (E. E. Austin; "From rat known as ground pig. Glides through the hair of the host with great quickness. E. E. A."); 1 ♀, 3 juv.

Bibianaha, Gold Coast; 1910; (Dr. Spurrell; "parasite on bush rat"); 1 ♀.

Accra, Gold Coast; November 19, 1914; (Dr. J. W. Scott Marfie); 1 ♂.

Accra, Gold Coast; 1919; (Dr. A. Ingram; "from *Cricetomys gambianus*"); 1 ♂, 2 ♀, 1 juv.

Obuasi, Ashanti, Gold Coast; July 16, 1907; (Dr. W. M. Graham; "caught on pig's feet"); 1 ♂, 3 ♀.

Near Lagos, Nigeria; (W. P. Lowe); 1 ♂.

Groups by having the ultimate tergite trigonally or trapezoidally produced instead of broadly transverse. From the members of the Talpoides Group the present species may be distinguished by its having the distal portion of the ultimate sternite smooth or with but a slight distal cingulation, while the members of the other species groups have a well marked submarginal carina and a submarginal sulciform impression. From the other member of the Advectus Group (*advectus*), *bouvieri* may be separated by its having the immediate apex of the ultimate tergite acute-angulate or narrowly rounded acute-angulate, instead of weakly and evenly arcuate.

The male of this species and that of *advectus* and *hanseni* differ from the other known males of this genus by having the process of the ultimate sternite directed dextrad instead of sinistrad. This sex of *bouvieri* may be separated from that of *advectus*, which has the distal margin of the penultimate tergite truncate, or from *hanseni*, which has this margin broadly obtuse-angulate with a definite and distinct median angle, by having the distal margin of the penultimate tergite with the lateral portions produced (see Figure 34) and the process of the ultimate sternite is not shaped like a meat cleaver or vomeriform.

*Specific characters.*<sup>41</sup>—As in all the other members of this genus the only specific differential characters are in the terminal abdominal segments.

*Female.*—Penultimate tergite transverse, symmetrically trapezoidal, greatest length approximately equal to one-half of caudal width; lateral margins evenly and gradually convergent caudad, then passing by a distinct obtuse-angulation into the subtruncate distal portion. Penultimate and ultimate tergites, in lateral view, with their axes in practically the same plane.

Ultimate tergite, as seen from the dorsum, trigonal, greatest median length equal to three-fourths of proximal width; lateral portions of distal margin gradually and evenly converging caudad to the narrowly rounded acute apex; ventral surface of this tergite deplanate, lateral margins supplied with a few rather long, spaced chaetae.<sup>42</sup>

Ultimate sternite transverse, median production elongate, semi-elliptical, greatest length of production equal to almost two-thirds of basal (proximal) width; proximo-lateral portions of the margin of this production concavely passing into the infra-cercal portion of the margin, apex of this production broadly and evenly rounded, the more distal portion of the margin distinctly cingulate, just proximad of this cingulation shallowly and broadly excavate but lacking any indication of a supplementary margin or a concentric channel; proximo-lateral sulciform impressions extending to the evident base of the sternite, subparallel, occasionally gradually divergent or at times

<sup>41</sup> These descriptions are based mainly upon two specimens, one female and one male, both from Bukoba, Lake Victoria, Tanganyika Territory.

<sup>42</sup> These chaetae are present in the specimen described and on some of the rest of the series. On the remainder we have been able to find the pits where they formerly were. The chaetae of all the members of this genus apparently are readily detached and their former presence is indicated solely by their sockets.

with greatest width between these impressions at evident base of sternite and next greatest width at their distal extremity, between these two points the impressions slightly but evenly convex mesad.

Cerci as in all the other members of the genus.

*Male*.—The terminal abdominal segments contain the only specific characters of this sex, as in the other members of this genus.

Penultimate tergite roughly symmetrically trapezoidal, greatest median length being to greatest width (proximal) as 13 is to 32; lateral margins oblique, convergent, distinct, length of same slightly less than the median length of the tergite, passing by a distinct obtuse-angulation into the somewhat produced, broadly obtuse-angulate distal margin. Penultimate and ultimate tergites, in lateral view, with their axes in the same plane, the dorsal line of the ultimate tergite, however, slightly deflexed ventro-caudad.

Ultimate tergite, in dorsal view, semi-ovate, exposed median length equal to one-half of proximal width, greatest length, *i.e.* from apparent lateral bases, slightly more than one-half of proximal width; more strongly arcuate distad than laterad.

Ultimate sternite transverse, low trigonal, slightly asymmetrical; greatest length (slightly dextrad of middle) slightly less than greatest width, length, excluding production, approximately two-thirds of greatest width: sinistral portion of distal margin slightly subangulate concave, dextral portion slightly and weakly sigmoid; production, as seen from venter, extending dextro-caudad, immediate apex pointing sinistrad; in lateral view, greatest length of production slightly less than one-third of greatest width of sternite, greatest width of production, *i.e.* at proximal shoulder, equal to about one-half of its greatest length, peduncle stout, forming about one-third the total length of the production, post-peduncular portion broad, compressed, with a well-developed and sharply defined proximal shoulder, ventral margin to distal third almost straight oblique, cultriform dorsal margin to distal third convex, distal third slightly sub-spatulate, broadly rounded.

Cerci as in the other members of the genus.

Parameres, for illustration of these appendages see Figure 46.

*Variation*.—The series of females of this species shows considerable variation in some features, mainly the shape of the distal margin of the penultimate tergite, which may be either slightly produced, subtruncate or with a very slight median production so as to appear obsoletely bisinuate. The ultimate sternite of the female does not always have the distal cingulation evident and the proximo-lateral sulciform impressions are quite variable in prominence and position; in extreme conditions they may be but partially discernible or conversely very prominent and extending to the evident base of the sternite; they may be gradually and evenly divergent proximad, subparallel or with the greatest width between these impressions at the evident base of the sternite and the next greatest width at their distal extremity, between these two points the impressions being slightly but evenly convex mesad.



In the males the process of the ultimate sternite varies in direction from dextro-caudad to dextro-ventrad, also the distal margin of the penultimate tergite may be slightly more produced than mentioned under the specific characters.

*Measurements (in millimeters) of representative individuals of  
Hemimerus bouvieri*

	Length of body (exclusive of cerci)	Median length of entire thorax	Greatest width of mesonotum
♀, Bukoba, Tang. Terr. .... (dry)	10.7	4.3	3.9
♀, Bukoba, Tang. Terr. .... (dry)	11.	4.	3.9
♀, Bukoba, Tang. Terr. .... (dry)	10.4	4.4	3.8
♀, Bukoba, Tang. Terr. .... (dry)	10.5	4.2	3.9
♀, Bukoba, Tang. Terr. .... (dry)	10.8	4.3	3.9
♀, Bukoba, Tang. Terr. .... (dry)	10.	4.	3.7
♀, Bukoba, Tang. Terr. .... (alc.)	11.6	4.7	4.2
♀, Bukoba, Tang. Terr. .... (alc.)	12.	4.7	4.2
♀, Bukoba, Tang. Terr. .... (alc.)	12.5	4.8	4.6
♀, Bukoba, Tang. Terr. .... (alc.)	12.3	4.5	4.2
♀, Bukoba, Tang. Terr. .... (alc.)	12.6	4.9	4.6
♀, Bukoba, Tang. Terr. .... (alc.)	12.	4.4	4.2
♂, Bukoba, Tang. Terr. .... (dry)	10.5	3.9	4.
♂, Bukoba, Tang. Terr. .... (dry)	10.3	3.9	3.6
♂, Bukoba, Tang. Terr. .... (dry)	10.5	3.9	3.8
♂, Bukoba, Tang. Terr. .... (dry)	10.5	3.9	3.8
♂, Bukoba, Tang. Terr. .... (dry)	10.8	3.6	3.4
♂, Bukoba, Tang. Terr. .... (dry)	10.3	3.6	3.8
♂, Bukoba, Tang. Terr. .... (alc.)	10.	3.9	3.4
♂, Bukoba, Tang. Terr. .... (alc.)	10.2	3.8	3.8
♂, Bukoba, Tang. Terr. .... (alc.)	9.8	3.5	3.6
♂, Bukoba, Tang. Terr. .... (alc.)	10.2	4.2	4.2
♂, Bukoba, Tang. Terr. .... (alc.)	9.2	3.9	3.8
♂, Bukoba, Tang. Terr. .... (alc.)	10.5	4.	4.2

*Distribution.*—From the Upper Kasai River (Dilolo, Lulua District) Belgian Congo, across Katanga (Kambove) and Urundi (Kitega) to the western shore of Lake Victoria (Bukoba), Tanganyika, and southward to the Pungwe River Valley (Guengère), Mozambique. The paucity of localities from which the species is known permits merely this linear statement of distribution.

*Host association.*—All of the previously reported material of this species was said to have been taken from *Cricetomys emini*. The host of the Bukoba specimens here examined was not specifically determined, and in consequence we are unable to supply any further information.

*Specimens examined.*—76: 43 ♀, 7 juv. ♀, 21 ♂, 2 juv. ♂, 3 juv. sex? Bukoba, western shore of Lake Victoria, Tanganyika Territory; 1921; (N. C. E. Miller, "from *Cricetomys sp.*"); 39 ♀ (29 ♀ alc., 10 ♀ dry), 7 juv. ♀ (alc.), 21 ♂ (15 ♂ alc., 6 ♂ dry), 2 juv. ♂ (alc.) 3 juv. sex? (alc.); [B.M. N.H.]; 4 ♀; [Hebard Cln.].

**Hemimerus advectus**, new species. Figs. 8, 17, 29, 35, 41 and 47.

This species, which is known from both sexes, is the typical member of the *Advectus* Group.

*Comparison*.—The female sex of the present species as well as of the other member of the *Advectus* Group (*bouvieri*), and those of the *Talpoides* Group, differ from those of the members of the *Hanseni* and *Vicinus* Groups by having the ultimate tergite trigonally or trapezoidally produced instead of broadly transverse. The female sexes of *advectus* and *bouvieri* differ from those of the forms of the *Talpoides* group by having the distal portion of the ultimate sternite smooth or with a very slight distal cingulation, while those of the latter groups have both a well marked submarginal carina and a submarginal sulciform impression. The female of *advectus* differs from that of *bouvieri* by having the immediate apex of the ultimate tergite weakly and evenly arcuate, instead of acute-angulate or narrowly rounded acute-angulate, as in the female of *bouvieri*.

The male of *advectus* and the males of *hanseni* and *bouvieri*, differ from those of the other known members of the genus by having the process of the ultimate sternite directed dextrad instead of sinistrad. The male of this species differs from that sex of *hanseni* and *bouvieri* by having the distal margin of the penultimate tergite truncate instead of mesad produced. In addition the process of the ultimate sternite of *advectus*, in lateral view, is shaped like a meat cleaver (see Figure 41), while in the other species this process is not similarly shaped.

*Type*.—♀; Pungo Andongo, Loanda District, Angola. June 9, 1903. (From type of *Cricetomys ansorgei* Thomas.) [British Museum of Natural History.]

With the exception of the terminal abdominal segments there are no regions of the body which furnish noteworthy specific differences when compared with allied species.

Penultimate tergite, in general form, symmetrically trapezoidal; lateral margins distad convergent to a point where the distance between the same is but slightly greater than one-half the proximal width, these lateral sections passing by an obtuse-angulation into the very slightly arcuate median portion.<sup>43</sup> In lateral view the plane of the dorsal surface of the ultimate tergite is seen to form an obtuse-angle with that of the penultimate tergite, the former being slightly deflexed ventro-caudad.

Ultimate tergite, as seen from the dorsum, in general form symmetrically trapezoidal; greatest width (proximal) equal to one and one-half times the median length; lateral portions of distal margin evenly and gradually convergent to a point where the distance between these is equal to slightly less than one-half the proximal width, this area being weakly and evenly arcuate

<sup>43</sup> In the two paratypes the median portion is truncate and we believe that this is the normal condition; however, this specimen, less typical in this feature, was chosen as type because of its more general completeness.

in outline; ventral surface of the ultimate tergite deplanate; <sup>44</sup> distal margin sparsely armed with spaced, short, heavy chaetae.

Ultimate sternite with median production semi-ovate; greatest length of the central portion from its base line is to its greatest width as 5 is to 8; lateral arcuate convergent margins of the median production in lateral aspect showing slight indications of a marginal cingulation; the proximo-lateral, evenly divergent sulciform impressions extend almost to the evident base of the sternite, dextral one throughout broader, less narrowly and more deeply excavate, proximad slightly broader than caudad.<sup>45</sup>

Cerei the same as those of the other members of this genus.

*Allotype*.— $\delta$ ; same data as type. [British Museum of Natural History.]

Male sex differing from the female solely in the features of the terminal abdominal segments.

Penultimate tergite, in general form, symmetrically trapezoidal, appreciably broader than twice the median length; lateral portions of distal margin gradually and evenly converging to a point where the distance between them is equal to two-thirds the proximal width; median portion of margin truncate. In lateral view the plane of the dorsal line of the ultimate tergite is practically the same as that of the penultimate tergite, there being no appreciable angulation between them, as the ultimate tergite extends almost directly caudad.

Ultimate tergite, when viewed from the dorsum, in general form symmetrically trapezoidal; greatest apical width practically equal to the greatest length; lateral portions of the distal margin slightly oblique-arcuate convergent, broadly rounding into the distal section which is arcuato-subtruncate; ventral surface of ultimate tergite strongly concave, vaulted, ventro-lateral margins with a few spaced, curved, elongate chaetae.

Ultimate sternite with distal margin unsymmetrically but in general subtrigonally produced mesad; length of median production (exclusive of cultriform process) equal to three-quarters of the greatest evident width of sternite, which in the allotype would be at the lateral bases of the distal margin; sinistral side of distal margin evenly oblique concave, dextral side of same weakly sigmoid; as seen from venter, entire distal margin of sternite rather thickly supplied with erect chaetae of varying length, those more laterad averaging longer; process, which in this species is directed ventro-distad, moderately compressed, with its peduncle circular in section and arcuate longitudinally, all of the process distad of the peduncle compressed, in lateral view much resembling a meat cleaver, with its immediate apex obliquely subtruncate and its ventral outline distad of the proximal shoulder gently arcuate; as seen in ventral aspect the process is directed slightly dextrad, its greatest length in the same view is equal to slightly less than one-third the greatest width of sternite (see Fig. 41).

Cerei as in the female and in the other members of the genus.

Parameres; for illustration of these appendages see Fig. 47.

<sup>44</sup> From the paratypic material we are able to see that this deplanate area extends cephalad to opposite the median production of the ultimate sternite, and at this point there is a transverse arcuate impression apparently outlining an impressed area to receive the ultimate sternite.

<sup>45</sup> In the type the dextral impression has split in its distal half.

*Paratypic series*.—We have indicated as paratypes two females from Caconda, District of Benguela, Angola, which are in the collection of the British Museum of Natural History.

*Variation*.—These paratypes are in all important respects identical with the type, except for the truncate median portion of the distal margin of the penultimate tergite, which has been discussed above. All of these specimens are preserved as dry material, and as a result we are unable to say what variation there may be found between alcoholic and dry specimens.

*Measurements (in millimeters) of representative individuals of  
Hemimerus advectus*

	Length of body (exclusive of cerci)	Median length of entire thorax	Greatest width of mesonotum
♀, Pungo Andongo, Angola, <i>type</i> .....	11.7	4.1	3.7
♀, Caconda, Angola, <i>paratype</i> <sup>46</sup> .....	14.2	5.3	4.3
♀, Caconda, Angola, <i>paratype</i> <sup>46</sup> .....	15.7	4.8	4.3
♂, Pungo Andongo, Angola, <i>allotype</i> .....	10.5 <sup>47</sup>	3.7	3.4

*Distribution*.—This species is known solely from two localities in Angola, i.e. Pungo Andongo and Caconda.

*Host association*.—The only information we have concerning the association of this species with any particular form of the host was gained from the information on the type. The field number of the host rat was placed on the *Hemimerus* series by its collector, and from this British Museum authorities are able to tell us the type was taken from the type of *Cricetomys ansorgei* Thomas. We believe that this species will be found only on this and very closely related forms of the host rats.

*Specimens examined*.—4; 3 ♀, 1 ♂. Pungo Andongo, Loanda District, Angola; (From type of *Cricetomys ansorgei* Thomas); 1 ♀, 1 ♂, (*type* and *allotype*); [B.M.N.H.]. Caconda, Benguela District, Angola; 2 ♀, (*paratypes*); [B.M.N.H.].

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<sup>46</sup> These specimens have been flattened and are greatly distorted.

<sup>47</sup> Abdomen exceptionally recurved.

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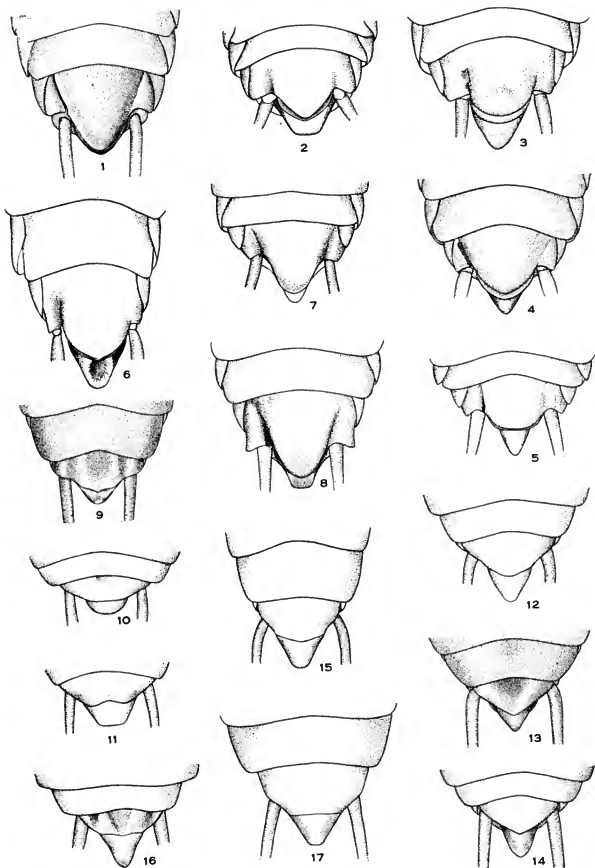
## EXPLANATION OF FIGURES

(all greatly enlarged)

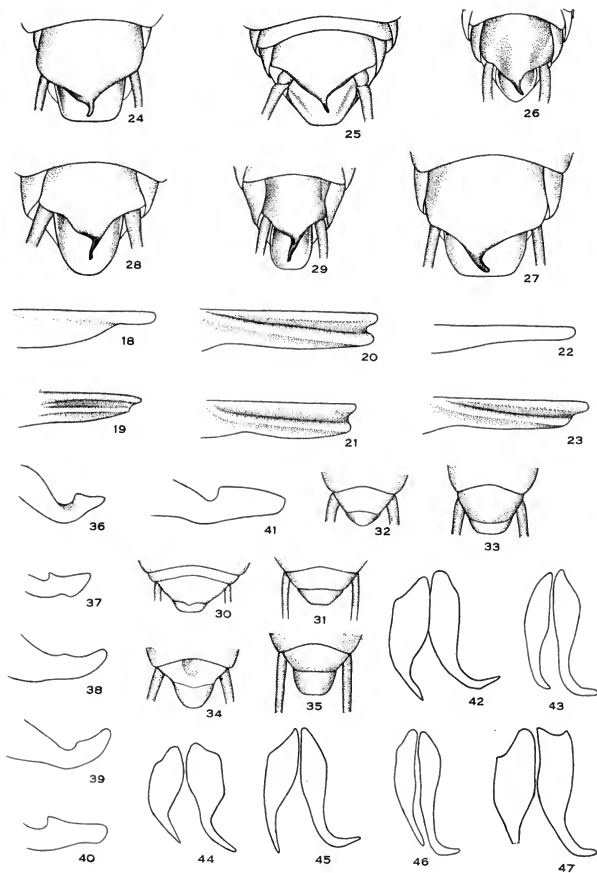
- Figure 1.—*Hemimerus hanseni* Sharp. ♀. Mt. Elgon, Uganda-Kenya. Ventral view of apex of abdomen.
- Figure 2.—*Hemimerus vicinus*, new species. ♀ (*type*). Ife, Nigeria. Ventral view of apex of abdomen.
- Figure 3.—*Hemimerus sessor*, new species. ♀ (*type*). Mt. Gargues, Kenya Colony. Ventral view of apex of abdomen.
- Figure 4.—*Hemimerus deceptus*, new species. ♀ (*type*). Transvaal. Ventral view of apex of abdomen.
- Figure 5.—*Hemimerus talpoides* Walker. ♀. Sierra Leone. Ventral view of apex of abdomen.
- Figure 6.—*Hemimerus vosscleri*, new species. ♀ (*type*). Amani, Usambara Mountains, Tanganyika Territory. Ventral view of apex of abdomen.<sup>44</sup>
- Figure 7.—*Hemimerus bouvieri* Chopard. ♀. Bukoba, Lake Victoria, Tanganyika Territory. Ventral view of apex of abdomen.
- Figure 8.—*Hemimerus advectus*, new species. ♀ (*type*). Pungo Andongo, Angola. Ventral view of apex of abdomen.
- Figure 9.—*Hemimerus hanseni* Sharp. ♀. Mt. Elgon, Uganda-Kenya. Dorsal view of apex of abdomen.
- Figure 10.—*Hemimerus hanseni* Sharp. ♀. Lolodorf, Cameroons. Dorsal view of apex of abdomen.
- Figure 11.—*Hemimerus vicinus*, new species. ♀ (*type*). Ife, Nigeria. Dorsal view of apex of abdomen.
- Figure 12.—*Hemimerus sessor*, new species. ♀ (*type*). Mt. Gargues, Kenya Colony. Dorsal view of apex of abdomen.
- Figure 13.—*Hemimerus deceptus*, new species. ♀ (*type*). Transvaal. Dorsal view of apex of abdomen.
- Figure 14.—*Hemimerus talpoides* Walker. ♀. Sierra Leone. Dorsal view of apex of abdomen.
- Figure 15.—*Hemimerus vosscleri*, new species. ♀ (*type*). Amani, Usambara Mountains, Tanganyika Territory. Dorsal view of apex of abdomen.
- Figure 16.—*Hemimerus bouvieri* Chopard. ♀. Bukoba, Lake Victoria, Tanganyika Territory. Dorsal view of apex of abdomen.
- Figure 17.—*Hemimerus advectus*, new species. ♀ (*paratype*). Caconda, Angola. Dorsal view of apex of abdomen.
- Figure 18.—*Hemimerus hanseni* Sharp. ♀. Ekibondo, Uele District, Belgian Congo. Lateral view of ultimate sternite.
- Figure 19.—*Hemimerus vicinus*, new species. ♀ (*type*). Ife, Nigeria. Lateral view of ultimate sternite.
- Figure 20.—*Hemimerus talpoides* Walker. ♀. Sierra Leone. Lateral view of ultimate sternite.
- Figure 21.—*Hemimerus vosscleri*, new species. ♀ (*type*). Amani, Usambara Mountains, Tanganyika Territory. Lateral view of ultimate sternite.
- Figure 22.—*Hemimerus bouvieri* Chopard. ♀. Bukoba, Lake Victoria, Tanganyika Territory. Lateral view of ultimate sternite.
- Figure 23.—*Hemimerus sessor*, new species. ♀ (*type*). Mt. Gargues, Kenya Colony. Lateral view of ultimate sternite.
- Figure 24.—*Hemimerus hanseni* Sharp. ♂. Batanga, Cameroons. Ventral view of ultimate sternite.
- Figure 25.—*Hemimerus deceptus*, new species. ♂ (*allotype*). Gobler's Farm, Northern Transvaal. Ventral view of ultimate sternite.
- Figure 26.—*Hemimerus talpoides* Walker. ♂. Freetown, Sierra Leone. Ventral view of ultimate sternite.
- Figure 27.—*Hemimerus vosscleri*, new species. ♂ (*allotype*). Amani, Usambara Mountains, Tanganyika Territory. Ventral view of ultimate sternite.
- Figure 28.—*Hemimerus bouvieri* Chopard. ♂. Bukoba, Lake Victoria, Tanganyika Territory. Ventral view of ultimate sternite.

<sup>44</sup> This figure shows the abdomen abnormally extended.

- Figure 29.—*Hemimerus advectus*, new species. ♂ (*allotype*). Pungo Andongo, Angola. Ventral view of ultimate sternite.
- Figure 30.—*Hemimerus hanseni* Sharp. ♂. Batanga, Cameroons. Dorsal view of apex of abdomen.
- Figure 31.—*Hemimerus deceptus*, new species. ♂ (*allotype*). Gobler's Farm, Northern Transvaal. Dorsal view of apex of abdomen.
- Figure 32.—*Hemimerus talpoides* Walker. ♂. Freetown, Sierra Leone. Dorsal view of apex of abdomen.
- Figure 33.—*Hemimerus vosseleri*, new species. ♂ (*allotype*). Amani, Usambara Mountains, Tanganyika Territory. Dorsal view of apex of abdomen.
- Figure 34.—*Hemimerus bouvieri* Chopard. ♂. Bukoba, Lake Victoria, Tanganyika Territory. Dorsal view of apex of abdomen.
- Figure 35.—*Hemimerus advectus*, new species. ♂ (*allotype*). Pungo Andongo, Angola. Dorsal view of apex of abdomen.
- Figure 36.—*Hemimerus hanseni* Sharp. ♂. Batanga, Cameroons. Lateral outline of process of ultimate sternite.
- Figure 37.—*Hemimerus deceptus*, new species. ♂ (*allotype*). Gobler's Farm, Northern Transvaal. Lateral outline of process of ultimate sternite.
- Figure 38.—*Hemimerus talpoides* Sharp. ♂. Freetown, Sierra Leone. Lateral outline of process of ultimate sternite.
- Figure 39.—*Hemimerus vosseleri*, new species. ♂ (*allotype*). Amani, Usambara Mountains, Tanganyika Territory. Lateral outline of process of ultimate sternite.
- Figure 40.—*Hemimerus bouvieri* Chopard. ♂. Bukoba, Lake Victoria, Tanganyika Territory. Lateral outline of process of ultimate sternite.
- Figure 41.—*Hemimerus advectus*, new species. ♂ (*allotype*). Pungo Andongo, Angola. Lateral outline of process of ultimate sternite.
- Figure 42.—*Hemimerus hanseni* Sharp. ♂. Mt. Elgon, Uganda-Kenya. Outline of parameres.
- Figure 43.—*Hemimerus deceptus*, new species. ♂ (*allotype*). Gobler's Farm, Northern Transvaal. Outline of parameres.
- Figure 44.—*Hemimerus talpoides* Walker. ♂. Freetown, Sierra Leone. Outline of parameres.
- Figure 45.—*Hemimerus vosseleri*, new species. ♂ (*paratype*). Kenya Colony ("British East Africa"). Outline of parameres.
- Figure 46.—*Hemimerus bouvieri* Chopard. ♂. Bukoba, Lake Victoria, Tanganyika Territory. Outline of parameres.
- Figure 47.—*Hemimerus advectus*, new species. ♂ (*allotype*). Pungo Andongo, Angola. Outline of parameres.







ZOOLOGICAL RESULTS OF THE THIRD DE SCHAUENSEE SIAMESE  
EXPEDITION, PART VII.—FISHES OBTAINED IN 1935

BY HENRY W. FOWLER.

A small collection was secured in North Siam and the Shan States during February, March and April. It includes 127 specimens, represented by 19 species of which two are described as new. This Academy is indebted to Mr. Rodolphe Meyer de Schauensee for this gift to its museum.

CLARIIDAE

*Clarias batrachus* (Linnaeus).

One, 170 mm., Laun We, Keng Tung, Feb. 20.

COBITIDAE

*Lepidocephalus hasseltii* (Valenciennes).

Nine, 62 to 86 mm., Laun We, Keng Tung, March 5.

Ten, 44 to 80 mm., Meng Pek, Mong Lon, March 24. These all paler than the preceding and with the darker markings obscured.

*Nemacheilus kengtungensis*, new species. Figure 1 (type).

Depth  $5\frac{3}{4}$  to 6; head  $3\frac{1}{2}$  to 4, width  $1\frac{1}{2}$  to  $1\frac{1}{4}$ . Snout  $2\frac{1}{2}$  to  $3\frac{1}{2}$  in head; eye 5,  $1\frac{1}{2}$  to  $1\frac{9}{10}$  in snout,  $1\frac{1}{4}$  to  $1\frac{1}{2}$  in interorbital; mouth width 3 in head; lips moderately broad, smooth; outer rostral barbel  $3\frac{1}{2}$ , inner  $2\frac{3}{4}$ ; maxillary  $3\frac{3}{4}$ ; interorbital  $3\frac{1}{4}$  to  $3\frac{5}{8}$ , low, but slightly convex. No suborbital spine or knob. Gill opening wide, with broad width of isthmus  $2\frac{1}{2}$  in head.

Scales very minute, obsolete. Lateral line distinct, axial, complete.

D. II, 8, 1, first branched ray  $1\frac{1}{2}$  in head; A. III, 5, 1, first branched ray  $1\frac{1}{2}$  to  $1\frac{3}{4}$ ; caudal  $1\frac{1}{10}$  to  $1\frac{1}{2}$ , little emarginate behind; least depth of caudal peduncle  $1\frac{3}{4}$  to  $2\frac{1}{4}$ ; pectoral  $1\frac{1}{2}$  to  $1\frac{3}{4}$ , rays 1, 9; ventral rays 1, 7, fin  $1\frac{1}{4}$  to  $1\frac{1}{2}$  in head.

Light brown generally, more or less uniform. Snout and interorbital with small dark brown spots, followed by larger and fewer spots or blotch on occiput. Iris gray. Barbels pale or whitish, like under surface of head. Four broad dark brown transverse bands on body before dorsal, 3 from dorsal base and 5 on tail behind dorsal, also narrow and darker to black one at caudal base. Fins all light brown, with blackish spot at dorsal origin, besides narrow, dark, short, median streak on each membrane. Other fins with scarcely any darker shading.

A.N.S.P., No. 64157, Laun We, Keng Tung, 5600 feet elevation. March 5, 1935. Length 50 mm. Type.

A.N.S.P., No. 64158, Loi Weve, Keng Tung. Feb. 10, 1935. Length 45 mm. Paratype.

Resembles *Nemacheilus myrmekia* Fowler, but with the dark bands different below the dorsal and 5 posterior, instead of 3 as in *M. myrmekia*.  
(Named for Keng Tung.)

### CYPRINIDAE

#### *Macrochirichthys laosensis* Fowler.

One, 213 mm., Old Ching Sen, North Siam, April 19. The dark post-occipital saddles not present, perhaps faded out.

#### *Cirrhinus jullieni* Sauvage.

Two, 128 to 148 mm., Old Chieng Sen, April 20. Both show upper edge of dorsal narrowly blackish.

#### *Mystacoleucus marginatus* (Valenciennes).

Twenty, 80 to 130 mm., Keng Tung, March 13; ten, 63 to 110 mm., Ming Pek, Mong Lin, March 22; five, 112 to 125 mm., Old Chieng Sen, April 20.

#### *Dangila siamensis* Sauvage.

Two, 132 to 143 mm., Old Chieng Sen, April 20.

#### *Osteochilus vittatus* (Valenciennes).

One, 155 mm., Old Chieng Sen, April 19. An interesting specimen showing the black lateral band very distinct or black posteriorly, extending out over median caudal rays to their ends, different from my figure 70 in these Proceedings, 1934. Moreover the dorsal fin is brilliant orange-pink anteriorly, while the rest of the fin, and the other fins are tinted with yellowish. D. III, 12, 1.

#### *Barbus bramoides* Valenciennes.

One, 169 mm., Old Chieng Sen, April 19.

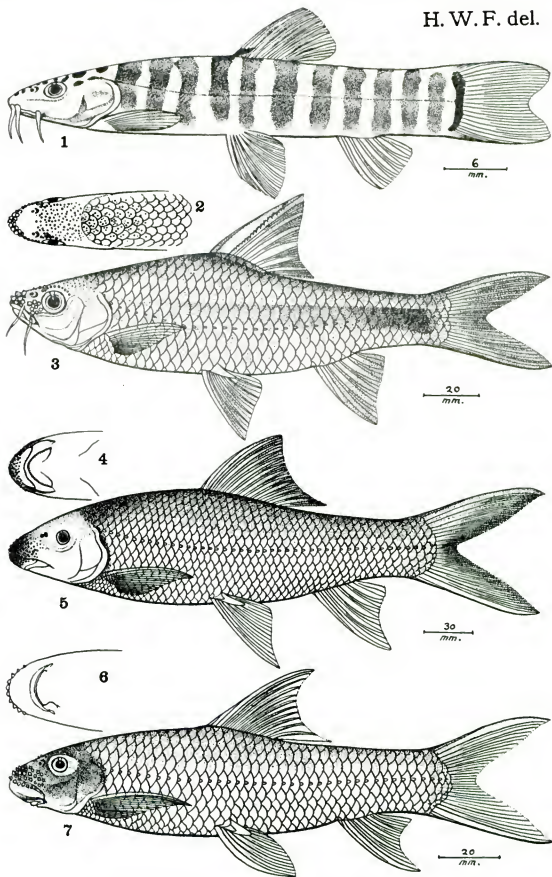
#### *Barbus shanensis* Hora and Murkeji. Figures 2 (head and predorsal above) and 3.

One, 198 mm., Meng Peck, Mong Lin, Shan States, March 23. The accompanying figures show the development of the pearl organs. Hora and Murkeji have based this species on two specimens 104 and 128.5 mm. without caudal, apparently non-breeding fishes.

#### *Varicorhinus dyocheilus* (MacClelland). Figures 4 (under view of head) and 5.

Depth  $3\frac{1}{2}$ ; head 4, width  $1\frac{3}{8}$ . Snout 2 in head, broad, rounded, convex, well overhanging mouth; eye  $6\frac{2}{3}$ ,  $3\frac{1}{2}$  in snout,  $3\frac{1}{8}$  in interorbital; maxillary not quite reaching to eye, with long, deep, oblique sulcus above; length from tip of snout  $2\frac{1}{8}$  in head; rostral fold broad before upper lip, its hind edge uneven though not fringed; upper lip broad, smooth, firmly coriaceous and largely sheathed by broad rostral fold; lower lip broad, edge with a series of rather large, though not very prominent papillae, and free edge not continuous across rather broad symphysis; a concealed pair of small maxillary barbels; nostrils moderate, together, separated by moderate cutaneous flap; interorbital  $1\frac{9}{10}$ , high, convex; suborbitals rather narrow, little invading cheek. Gill rakers  $10 + 40$ ?, short, pointed laminae,  $\frac{1}{8}$  of gill filaments, which  $1\frac{1}{2}$  times eye. Pharyngeal teeth not located.

H. W. F. del.



1. *Nemacheilus kengtungensis*. 2, 3. *Barbus shanensis*.  
 4, 5. *Varcorhinus dyocheilus*. 6, 7. *Labeo lippus*.

Scales  $40 + 3$  in lateral line; 8 above, 6 below to ventral origin, 7 below to anal origin, 20 predorsal. Scales on chest and breast small. Caudal base with scales little smaller than those on body. Scales with 36 apical finely radiating striae, with median approximated at median axis of scale; 23 apical radiating striae; circuli fine, obsolete apically. Lateral line complete, axial, tubes small, simple and each little exposed.

D. iv, 11, 1, first branched ray but slightly less than head; A. iii, 5, 1, first branched ray  $1\frac{1}{10}$ ; least depth of caudal peduncle  $1\frac{2}{3}$ ; pectoral  $1\frac{1}{10}$ , rays 1, 15; ventral rays 1, 8, fin equals head; caudal deeply forked,  $2\frac{2}{3}$  in rest of fish.

Brown, paler below, evidently whitish on under surfaces of both head, trunk and tail. At base of each scale on sides of body a dark underlaid spot, due to pigment of scale pocket. Brownish bar along humeral region of gill opening. Iris gray, with pale or very light brown ring around pupil. Fins all light brownish or pale, and all except ventrals more or less bordered with grayish.

One, 315 mm., Old Chieng Sen, North Siam, April 1935. The pearl organs are well developed over the front of the snout and very minute ones scattered over the upper surface of the head, quite inconspicuous.

*Varicorhinus discognathoides* Nichols and Pope 1927 from Hainan and *Varicorhinus tonkinensis* Pellegrin 1934 from Nghia Lo, Tonkin, appear to be synonyms. Both are, however, described as without barbels, which may have been overlooked.

**Labeo lippus**, new species. Figures 6 (under view of head) and 7.

Depth  $3\frac{3}{4}$ ; head  $4\frac{2}{3}$ , width  $1\frac{2}{3}$ . Snout 2 in head; eye  $5\frac{3}{4}$ ,  $2\frac{1}{2}$  in snout,  $2\frac{2}{3}$  in interorbital; maxillary not quite reaching eye, length from snout tip  $2\frac{2}{3}$  in head; rostral fold broad, largely sheaths upper lip, its edge entire; upper lip tough though pliable, entire; lower lip with a firmly cartilaginous entire margin bordered behind by a narrow papillate fold; no barbels; interorbital  $2\frac{2}{3}$  in head, moderately elevated, convex; suborbitals moderate, invade about half of cheek to preopercle keel; opercle smooth. Gill rakers  $14 + 24$ , short, uniform, flexible points,  $\frac{1}{2}$  of gill filaments, which  $1\frac{1}{2}$  times eye. Left pharyngeal teeth 5, 4, 3, with broad grinding surfaces, smooth.

Scales  $36 + 3$  in lateral line; 5 above, 4 below to ventral origin, 5 below to anal origin, 16 predorsal. Scales smallest and crowded on chest and breast. Caudal base scaled, but scales scarcely smaller than others. Scales with 45 fine radiating apical striae and 37 basal; circuli very fine, more or less obsolete apically. Lateral line complete, axial, of small, simple tubes, little exposed.

D. iii, 10, 1, first branched ray  $3\frac{3}{4}$  in fish without caudal; A. iii, 5, 1, first branched ray  $4\frac{2}{3}$ ; caudal  $2\frac{2}{3}$ , deeply forked; least depth of caudal peduncle  $1\frac{2}{3}$  in head; pectoral  $4\frac{1}{10}$  in fish without caudal, rays 1, 16; ventral rays 1, 8, equals head.

Dark olive brown generally, light to paler on under surfaces, perhaps whitish in life. Upper surface of head blackish brown and sides more or less dark gray brown. Iris gray, and pale border around eye, more broad or extensive behind. Pearl organs light brownish. Fins brownish. Membranes of dorsal rather dark gray terminally. Caudal more or less darker gray marginally. Paired fins with upper surfaces grayish, lower surfaces paler.

A.N.S.P., No. 64159. Meng Pek, Mong Lin, Shan States. March 18. Length 310 mm. Type.

A species apparently unique in its coloration, small head, long falcate fins and with 2 or 3 rows of moderate-sized pearl organs along the front of the snout, though all on its dorsal surface.

(*Lippus*, bleary-eyed.)

***Tylognathus cryptopogon*** Fowler.

One, 96 mm., Old Chieng Sen, April 20. Dorsal edge broadly black and the black vertical streak on the membranes of the fin very distinct and contrasted.

***Barbichthys laevis*** (Valenciennes).

Two, 133 to 204 mm., Old Chieng Sen, April 20.

***Carassius auratus*** (Linnaeus).

Twenty-four, 107 to 270 mm., from Keng Tung, March 7 to 21.

***Barilius harmandi*** (Sauvage).

Five, 190 to 265 mm., Meng Lin, Shan States, March 23.

#### MASTACEMBELIDAE

***Rhynchobdella aculeata*** (Bloch).

Four, 128 to 174 mm., Old Chieng Sen, April 10. Ocelli variable.

#### ANABANTIDAE

***Trichopodus trichopterus*** (Pallas).

Five, 71 to 98 mm., Old Chieng Sen, April 20; four, 79 to 90 mm., Keng Tung, March 10.

#### CHANNIDAE

***Channa gachua*** (Buchanan-Hamilton).

Seven, 69 to 103 mm., Keng Tung, March 12 and two, 40 to 41 mm., Feb. 10; one, 126 mm., Loisan, Keng Tung, Feb. 20.

FRESH-WATER FISHES OBTAINED IN GUATEMALA BY MR. RODOLPHE  
MEYER DE SCHAUENSEE IN 1935

BY HENRY W. FOWLER.

Mr. and Mrs. de Schauensee made an interesting collection of fresh-water fishes during their recent trip to Guatemala. These specimens were obtained at a number of localities from both sides of the continental divide, so in the case of large series I have grouped them according. The collection consists of 2043 specimens and though only represented 22 species, four appear to be undescribed. Mr. de Schauensee made extensive color notes of fresh or living specimens, credited to him below by means of quotation marks. This Academy is indebted to Mr. and Mrs. de Schauensee for this gift, the first collection of fishes it has received from Guatemala. In listing the materials the first numeral refers to the number of specimens. The numbers in parenthesis refer to the smallest and then the largest specimen, if a series, and are intended for the total length in millimeters.

CHARACIDAE

**Astyanax fasciatus aeneus** (Günther). Figures 1 and 2 (El Roncho), 3 and 4 (brook between San Cristobal and Santa Cruz).

*Atlantic Specimens*

Rio San Vicente, Coban, 4000 feet elevation, 5 (66 to 88) Feb. 20. "Silvery blue, very bright, with a wide dark blue line above lateral line, deepening into black at caudal base and forming a large black diamond bisecting the tail. Belly white. Head iridescent violet to golden green. Dorsal clear dusky. Caudal very pale yellow. Anal and paired fins clear, but rather well tinged with salmon at base. Iris white." Also 12 (18 to 90) Feb. 21. A. III, 22, 1, to III, 24, 1.

Brook near San Cristobal 32 (23 to 42), Feb. 21. "Dull greenish, with several vertical black bars. Dorsal, anal and caudal pale sulphur yellow. Paired fins clear."—Brook between San Cristobal and Santa Cruz 98 (30 to 65) Feb. 19. "Silvery green, more dusky above. Belly white. Anal with anterior part bright cherry red, fading clear posteriorly. Caudal cherry red, bisected by a wide black band which starts at caudal base. Paired fins cherry red. Main series of specimens show colors of fins and tail variable, from cherry red and yellow to clear."

② Rio Motagua at El Rancho 1 (84) Feb. 17. "Silvery, with a wide dark blue stripe along lateral line. Three dark vertical bands behind head, first  $\frac{1}{4}$  of body. A dusky median dorsal line. Iris pale yellow. Both dorsals

clear. Anal deep red in front, fading clear at front end. Caudal red, dusky at center."—Also 3 (62 to 94) Feb. 23. "Silvery, darker above. Tail yellow. Dark spot at caudal base continued in thin line through tail. Caudal in smaller 2 yellow, in larger red. Anal and ventrals red."—On Feb. 24, 14 (73 to 101). "Silvery, darker above, with a pale line; slightly tinged with golden from base of head to root of tail. Iris white. Dorsal dusky yellow. Caudal yellow, divided by a black line. Anal and paired fins red."

Tributary of Rio Motagua 20 miles west of El Rancho 29 (63 to 125) Feb. 23. "Silvery bluish above, belly white. Cuneate black mark behind the head. Rhomboid black blotch at caudal base, dividing caudal lobes. Caudal yellow. Other fins deep salmon red." Depth  $2\frac{3}{4}$  to 3. In smallest A. 111, 24, base long as head.

#### *Pacific Specimens*

Lake Atitlan, 5000 feet elevation, near shore 3 (107 to 120) Jan. 29. "General color bronze green, much darker above, and with a violet luster on the dorsal region. Bones of head green, shot with violet. Chin cherry red, edged with black. Iris yellow, red above. Dorsal clear. Anal pink, turning to deep salmon near anus. Caudal pale green. Pectoral gray green. Ventral salmon pink." Depth  $3\frac{1}{4}$  to  $3\frac{3}{4}$ .

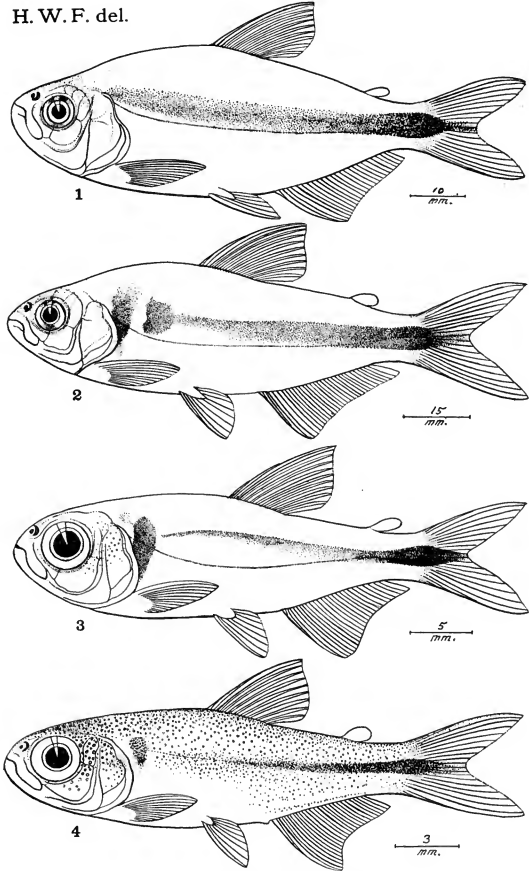
Stream at Amatitlan 21 (60 to 111) March 2. Depth 3 to  $3\frac{3}{4}$ . Anal slightly less to but slightly longer than head. Ventral and front of anal red in some specimens.—Lake Amatitlan 23 (62 to 103) in March. All pale, evidently due to formaline. Dark shoulder and caudal spots not very distinct. Larger specimens with small nuptial hooks on anterior and inner surfaces of ventral rays, uniserial, sharp pointed and feel rough to skin of hand as drawn across. Depth  $2\frac{3}{4}$  to  $2\frac{3}{4}$ . Front of anal and ventral rosy.

**Brycon guatemalensis** Regan. Machaca. Figures 5 and 6.

Materials all from the Rio Motagua at El Rancho.—One poorly preserved (47 mm. without caudal) Feb. 17.—Large example (510) Feb. 23. "General color of back olive, splotched all over with peacock blue. Top of head dusky green. Belly iridescent white, like mother of pearl. Mandible white. Bones of cheek golden bronze. Iris blue, above golden and very pale below. Dorsal flesh color. Adipose fin basally blue, then subbasal longitudinal pink band and dusky submarginal bar with apex clear. Caudal rays flesh color, with blue webbing between. Anal pink anteriorly, turning to blue medially. Pectoral clear. Ventral rays pink, with pale blue webbing." Also 2 (66 to 68) same date. "Blue and silvery above, below silvery. Iris white. Blue black line at caudal base. All fins clear." Four (54 to 62) Feb. 24. "Silvery, darker above. Iris white. Caudal edged black, but without distinct blotch at base [though very distinct in alcoholic specimens]. Pectoral clear, other fins tinged with pink."



H. W. F. del.



1 to 4. *Astyanax fasciatus aeneus*.

## TACHYSURIDAE

**Tachysurus melanopus** (Günther).

Rio Motagua at El Rancho 9 (164 to 227) Feb. 23 and 24. "Dusky above, shot with bluish green on sides of head and body. Maxillary barbels blackish, mental whitish. Iris white. Fins dusky." Agree in every way with Regan's account and figures of the types of *Arius melanopus*. I cannot find *Galeichthys aguadulce* Meek, from Perez, Rio Rapaloapam, Mexico, is different.

## PIMELODIDAE

**Rhamdia motaguensis** (Günther).

El Rancho, Rio Motagua 1 (202) Feb. 24.

**Rhamdia godmani** (Günther).

El Rancho 1 (223) Feb. 23. "Generally dusky green above. Below sides paler, indistinctly shot with mother of pearl. Under surface of head and belly pinkish white. Maxillary barbel dusky, mentals white. Iris yellow. Dorsal dusky basally, then rather wide subbasal clear longitudinal band, terminally dusky. Anal clear. Ventral pinkish."

**Rhamdia brachycephala** Regan. Figures 7 (head viewed above) and 8.

El Rancho 9 (133 to 202). Feb. 23 specimens "greenish, mottled with darker green, whitish below. Maxillary barbels green, mentals white. Fins pale yellow." Feb. 24 specimens "pale golden green. Lower lobe of caudal and outer  $\frac{1}{3}$  of dorsal marked black."

**Rhamdia amatitlanensis**, new species. Figures 9 (head viewed above) and 10.

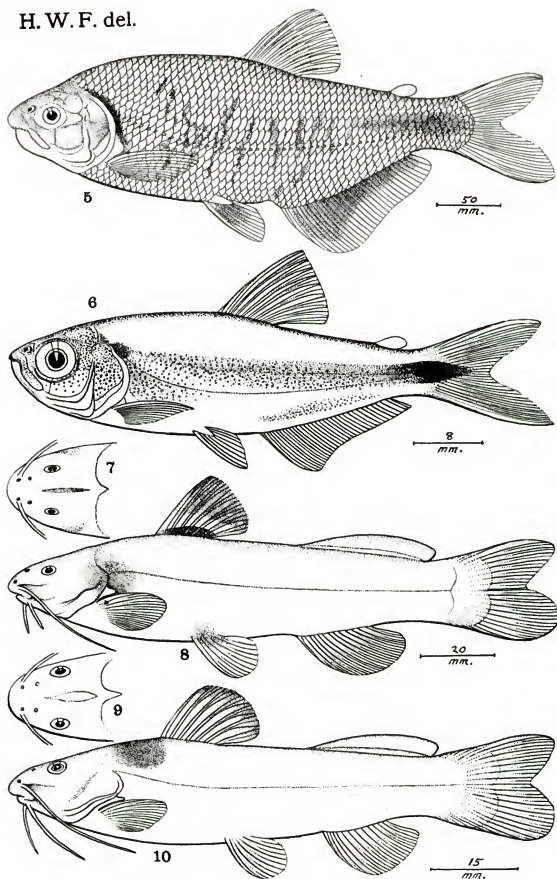
Depth  $4\frac{1}{2}$ ; head 4, width  $1\frac{1}{2}$  in its length. Snout  $2\frac{1}{2}$  in head; eye  $5\frac{1}{2}$ ,  $2\frac{1}{2}$  in snout; mouth width  $2\frac{2}{3}$ ; maxillary barbel reaches nearly to end of depressed pectoral spine; outer mental nearly to pectoral origin, or length  $1\frac{1}{2}$  in head; inner mental  $2\frac{1}{2}$ ; interorbital 3, low, level. Gill rakers  $4 + 10$ , lanceolate,  $1\frac{1}{2}$  in gill filaments, which subequal with eye.

Skin smooth. Narrow occipital fontanel nearly reaches base of occipital extension, length of which  $3\frac{1}{2}$  to origin of dorsal. Humeral extension  $\frac{3}{8}$  of depressed pectoral spine, which  $1\frac{1}{2}$  in fin or  $2\frac{1}{2}$  in head. Lateral line distinct, axial, complete.

D. I, 6, spine entire, terminal half flexible, 2 in head, second ray  $1\frac{3}{8}$ ; A. III, 10, third branched ray 2; adipose fin  $3\frac{1}{2}$  in fish without caudal; caudal very little emarginate behind, length  $1\frac{1}{2}$  in head; least depth of caudal peduncle 2,  $1\frac{1}{2}$  in its length from base of last anal ray; pectoral  $1\frac{3}{4}$  in head, rays I, 9, spine firm, outer edge entire, inner edge with 5 or 6 rather large, concealed, antrorse denticles; ventral rays I, 5, fin  $1\frac{3}{4}$  in head.

In alcohol pale olive above, sides below and under surfaces of both head and body with chrome tinge, all lighter than above. Iris gray. Lips pale to whitish. Maxillary barbel olive above and terminally, whitish below. Mental barbels white. Dorsals and caudals very pale brownish or grayish terminally. Paired fins whitish.

H. W. F. del.

5, 6. *Brycon guatemalensis*. 7, 8. *Rhamdia brachycephala*.9, 10. *Rhamdia amatillanensis*.

"Entirely yellow, with a dark predorsal blotch," latter still evident in alcohol.

A.N.S.P., No. 64136. Stream issuing from Lake Amatitlan. March 2. Length 97 mm. Type.

Distinguished from *Rhamdia salvini* (Günther) by its less emarginate caudal and more posterior position of the anal. Moreover Regan's figure shows a dark or basal blackish band to the dorsal, and also a black lateral band along the lateral line, not mentioned in his description. Other features of *R. salvini* shown in the figure, are its much shorter pectoral spine and more elongate body.

*Rhamdia rogersi* Regan, from Costa Rica, agrees in its caudal but slightly emarginate behind, though its anal is more advanced and its adipose fin is much shorter. *Rhamdia cabreræ* Meek 1907, also from Lake Amatitlan, has short barbels and its humeral extension only  $\frac{1}{3}$  of the depressed pectoral spine.

(For Lake Amatitlan.)

#### GYMNOTIDAE

*Gymnotus carapo* Linnaeus.

Lake Amatitlan 2 (143 to 182) March 2. "General color orange brown, mottled and streaked all over with dark brown."

#### CYPRINODONTIDAE

*Profundulus punctatus* (Günther). Figures 11 to 18 (Tecpam) and 19 and 20 (brook near San Cristobal).

##### *Atlantic Specimens*

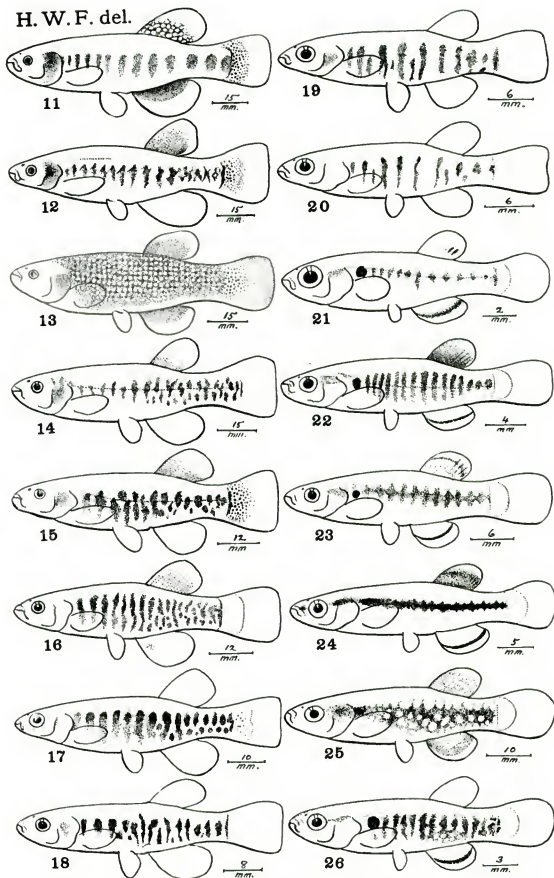
Brook between San Cristobal and Santa Cruz 1 (30) Feb. 19. "Greenish, with several wedge-shaped black vertical bands."—Brook near San Cristobal 2 (32 to 35) Feb. 21.—Rio de la Vachas, 3 miles east of Guatemala City 2 (28 to 30) Feb. 24.

##### *Pacific Specimens*

Antigua 1 (63) Feb. 9. "Generally iridescent golden green above lateral line, turning to violet blue below. Back marked with red, and black line from occiput to dorsal. Cheek iridescent. An indistinct dusky spot before each eye. Belly white. Dorsal, anal and caudal yellow. Pectoral clear."

Rio Chajic, Tecpam, 7200 feet elevation 33 (38 to 139) March 1. "Above yellowish green, with a dark line from the back of head to base of dorsal. Flanks with an opalescent blue sheen. Belly white. Dorsal clear dusky, anal and ventral pink. Pectoral clear." All quite variable, especially the young, which are marked with dark spots.

H. W. F. del.



11 to 20. *Profundulus punctatus*. 21 to 26. *Profundulus scapularis*.

Stream issuing from Lake Amatitlan, 3800 feet elevation, 3 (79 to 83) March 2.

**Profundulus scapularis**, new species. Figures 21 to 23 (El Zapote), 24 (Chimateneago), 25 and 26 (Moco).

Depth 4 to  $4\frac{1}{2}$ ; head 3 to  $3\frac{1}{2}$ , width  $1\frac{1}{2}$  to  $1\frac{3}{4}$ . Snout  $2\frac{1}{2}$  to  $3\frac{1}{2}$  in head from snout tip; eye  $3\frac{1}{2}$  to  $4\frac{3}{4}$ , little greater than snout in young to  $1\frac{1}{2}$  in snout with age,  $1\frac{3}{4}$  to 2 in interorbital; maxillary reaches  $\frac{2}{3}$  to  $\frac{3}{4}$  in snout, length to snout tip  $2\frac{1}{4}$  to  $3\frac{1}{4}$  in head from snout tip; teeth in rather broad bands in jaws, minute, conic, simple, in 5 transverse, irregular series; interorbital  $1\frac{1}{4}$  to 2 in head from snout tip. About 16 lower gill rakers, lanceolate,  $\frac{1}{2}$  of gill filaments, which  $1\frac{1}{4}$  in eye.

Scales 29 or  $30 + 3$  or 4 in median lateral series; 11 or 12 transversely from dorsal origin to anal origin; 21 to 23 predorsal scales, large on top of head. Basal  $\frac{2}{3}$  to  $\frac{3}{4}$  of caudal with fine scales. Scales with 12 or 13 basal radiating close-set striae; circuli fine basally, fewer or obsolete apically.

D. 1, 11, 1, third branched ray  $2\frac{1}{4}$  to  $2\frac{3}{4}$  in total head length; A. 1, 12, 1 or 1, 13, 1, fourth branched ray  $2\frac{1}{4}$  to  $2\frac{3}{4}$ ; caudal  $1\frac{1}{2}$  to  $1\frac{3}{4}$ , rounded in young, middle of hind edge truncate with age; least depth of caudal peduncle  $1\frac{9}{10}$  to  $2\frac{1}{2}$ ; pectoral  $1\frac{1}{2}$  to  $1\frac{3}{4}$ , rays 1, 16; ventral rays 1, 5, fin length  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in total head length.

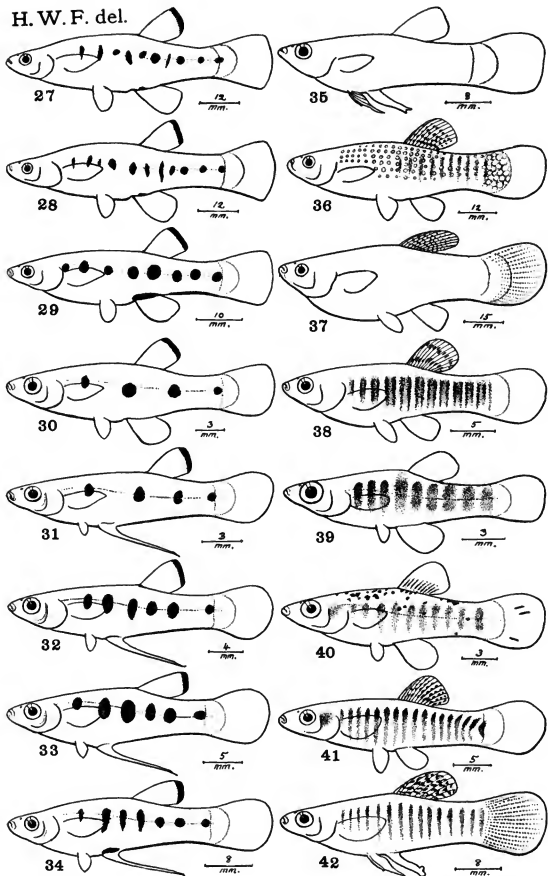
In alcohol gray brown above, and on sides, under surfaces paler to whitish. Each scale on trunk and tail, also larger on basal half of caudal, with darker or gray black spot. Iris dark gray. Blackish blotch, little less than eye, above pectoral behind large humeral scale; very contrasted and usually conspicuous in young, less so with age. Young also with median, broad, dark to blackish lateral band, which usually traversed with 10 to a dozen close-set still darker parallel bars. Dark bars very variable and their irregularities may even form rounded blotches or spots. Lips grayish. Dorsal gray basally, paler marginally; rays basally with blackish which often intersected variably with blackish bars. Anal grayish, with broad pale to whitish margin which is still broader in young examples. Paired fins pale.

A.N.S.P., No. 64137. Rio Bravo, Hoca. March 6. Type. Length 78 mm. Also Nos. 64138 to 64147, paratypes, same data. Length 33 to 80 mm.

This species is very similar to *Profundulus candalarius* Hubbs 1924, from the Atlantic drainage of Guatemala. Its coloration is apparently different as the scales are said to be "light where exposed, but marked by dark crescents at their bases; dark streaks are evident between each of the longitudinal scale rows. There is a dark axillar blotch. The fins are not distinctly marked; the anal probably had a light margin."

All my materials belonging to the Pacific drainage are: El Zapote, 2500 feet elevation 11 (16 to 80) Feb. 10. Seven larger specimens with black band along side of body and another from occiput to front of dorsal. Black lateral band bordered above and below by irregular round pale spots.

H. W. F. del.



27 to 34. *Poecilistes pleurospilus*. 35 to 42. *Mollienesia sphenops*.

Three smaller examples with a round black spot above depressed pectoral." Four smallest "silvery, with many dusky vertical bars on sides. Fins clear, anal tinged with orange marginally."

Small lake at Moco, 3050 feet elevation, foot of volcano of Atitlan 11 (18 to 47) March 6. "Above greenish, with dusky lateral band. Body dappled all over above, except middle of back, with blue. A large round black spot behind gill opening above, surrounded by glittering bronze gold. Iris olive yellow. Top of head, from eyes to mouth, whitish. Dorsal and caudal pale yellow, edges clear. Paired fins clear."

Small stream at Chimateneago 48 (19 to 72) March 3.

(*Scapula* shoulder, with reference to the black blotch behind the gill opening.)

### POECILIIDAE

**Poecilistes pleurospilus** (Günther). Figures 27 and 28 (stream from Lake Amatitlan), 29 to 33 (Antigua), and 34 (stream from Lake Amatitlan).

#### *Atlantic Specimens*

Rio Motagua at El Rancho 52 (13 to 33) Feb. 17. "Silvery, with a variable number of round black spots above lateral line. All fins clear."—Also 53 (13 to 28) Feb. 24, same locality.—Tributary of Rio Motagua 20 miles west of El Rancho 34 (15 to 64) Feb. 23.—Rio San Vicente, Coban 26 (13 to 28) Feb. 21.

#### *Pacific Specimens*

Lake Atitlan 44 (33 to 52) Jan. 30; 27 (12 to 15) Jan. 29; 30 (32 to 38) Feb. 8.—Lake Amatitlan 1 (43) Jan. 29.—Rio Guacalate near Esperintla 78 (12 to 29) Feb. 7. "Silvery, with 4 to 6 black spots."

Antigua 222 (11 to 25) Feb. 8. "Silvery blue, with round black spots."—Also 81 (18 to 68) Feb. 9, same locality. "Iridescent violet, with 4 to 6 black spots arranged in lateral series on body longitudinally. Belly and sides of chest clear white. Iris white. Smallest specimens bluish, with 8 vertical black bars or blotches. Belly white. Under side of head blue. Iris yellow. Fins clear."

Stream issuing from Lake Amatitlan 14 (40 to 88) March 2.—Small lake at Moco at foot of volcano Atitlan, 3050 feet elevation 1 (20) March 6. "Silvery, with 5 round black spots laterally. Fins clear, dorsal dusky."

**Mollienesia sphenops** (Valenciennes). Figures 35 to 37 (stream from Lake Amatitlan), 38 to 40 (El Rancho), 41 (west of El Rancho), and 42 (Lake Atitlan).

#### *Atlantic Specimens*

Rio Motagua at El Rancho 34 (12 to 57) Feb. 17. "Some marked with rather indistinct dusky vertical bands. General color silvery"; 1 (80) Feb. 23. "Dull green. Belly white. Head shot with blue. Dorsal red.



Caudal pale yellow"; 21 (18 to 90) Feb. 24. "Olive, specked above with pale blue in some lights. Belly white. Dorsal red, with numerous small black dots."

Affluent of Rio Motagua 20 miles north west of El Rancho 2 (25 to 62) Feb. 22. "Dark green above, shot with blue around head. Belly white."—Small tributary of Rio Motagua 20 miles west of El Rancho 57 (18 to 59) Feb. 23. "Olive green. Dorsal cherry red. Caudal pale yellow. Anal and ventral orange. Pectoral clear."

Rio de la Vachas 3 miles east of Guatemala City 3 (35 to 60) Feb. 24. "Greenish above, turning to iridescent peacock blue on anterior part of body. Belly white. Caudal pale yellow, rest of fins clear."

#### *Pacific Specimens*

Lake Atitlan 1 (46) Jan. 30.—Stream issuing from Lake Amatitlan 334 (47 to 110) March 2. This series shows great variation in color. Many have caudal dark basally. The intensity of the spots is variable, and all are more or less bright yellow on the back.

### MUGILIDAE

*Agonostomus macracanthus* Regan.

One from the Rio Motagua at El Rancho 123 mm. Feb. 24. "Silvery, greenish above, sides of belly tinged pink. Iris dusky. Gills edged with pink. Fins clear, tinged pink, strongly at caudal base, on anal and pectorals."

### POMADASYIDAE

*Pomadasys crocro* (Cuvier).

Rio Motagua at El Rancho 2 (182 to 233) Feb. 23. "Silvery. Anal spines white. Fins dusky."

### CICHLIDAE

*Cichlasoma caeruleogula*, new species. Figure 43 (type).

Depth  $2\frac{2}{5}$  to  $2\frac{1}{2}$ ; head 3 to  $3\frac{1}{8}$ , width  $1\frac{3}{8}$  to  $1\frac{1}{4}$ . Snout  $2\frac{1}{4}$  to  $2\frac{2}{5}$  in head; eye  $3\frac{3}{4}$  to  $4\frac{3}{4}$ ,  $1\frac{1}{2}$  to 2 in snout,  $1\frac{3}{4}$  to 2 in interorbital; maxillary reaches  $\frac{2}{3}$  to  $\frac{3}{4}$  to eye, length  $2\frac{9}{10}$  to  $3\frac{1}{2}$  in head; teeth simple, conic, in about 4 series transversely and outer row dark brown, with anterior median 6 to 8 enlarged; lips rather broad, fleshy, lower free across chin; mouth cleft slightly inclined downward forwards from horizontal; interorbital  $2\frac{3}{4}$  to  $2\frac{3}{4}$ , convex; preopercle edge entire. Gill rakers  $4 + 7$ ,  $\frac{1}{3}$  of gill filaments, which  $1\frac{1}{2}$  in eye.

Tubular scales 21 or 22 in upper section of lateral line,  $12 + 1$  in lower section; 6 above, 12 below, 13 predorsal forward opposite eye center; 5 or 6 rows on cheek to preopercle ridge. Caudal with fine scales basally. Scales on chest and breast quite small. Scales with 9 to 23 close-set basal radiating striae; 26 to 42 small weak apical denticles, with 4 to 7 series of basal elements; circuli fine, feeble or obsolete apically.

D. XVIII, 12, 1, last spine  $2\frac{1}{4}$  to  $2\frac{3}{8}$  in head, sixth ray  $1\frac{1}{4}$  to  $1\frac{3}{8}$ ; A. VI, 9, 1, last anal spine 2 to  $2\frac{3}{8}$ , fifth anal ray  $1\frac{1}{2}$  to  $1\frac{3}{8}$ ; caudal  $1\frac{1}{8}$  to  $1\frac{1}{4}$ , truncate behind and rounded above and below; least depth of caudal peduncle  $2\frac{1}{2}$  to  $2\frac{1}{4}$ ; pectoral  $1\frac{1}{4}$  to  $1\frac{1}{2}$ , rays 1, 15; ventral rays I, 5, fin  $1\frac{1}{8}$  to  $1\frac{1}{2}$  in head.

In alcohol dark gray brown above and on upper surface of head, obscurely marked with dark to blackish scattered dots, specks or small spots. On body 6 broad, ill defined, dark brown transverse bands, wider than pale interspaces. Each of these dark transverse bands darkened or blackened below axis of body, and last as much more contrasted black blotch at caudal base. Lower surface of head and branchiostegal region livid or gray black, only partly so in half grown specimens and pale or light like belly in young. Iris and lips gray, latter pale in young. Most examples show dark longitudinal bands parallel with scale junctures, usually not well defined though traversing dark vertical bands as well as the paler interspaces. Vertical fins gray brown, with rows of fine darker spots on all membranes of soft fins, fewer and larger in smaller specimens. Paired fins dark gray, ventrals pale or whitish in young examples.

A.N.S.P., No. 64148. Tributary of Rio Motagua about 20 miles west of El Rancho. February 23. Length 180 mm. Type. When fresh "general color blue, spotted all over with red. Five dusky vertical bands on side. Head dusky, spotted with blue. Region between gills and lower part of head blue. Lips blackish. Dorsal, anal and caudal red, spotted with blue. Pectoral yellow. Ventral dusky."

Also Rio Motagua at El Rancho, Nos. 64149 to 64152, paratypes. February 17. Length 105 to 152 mm. "Above dusky greenish, with 8 parallel lines of brick red spots below the lateral line. Between the lines of red spots the ground color blue. Belly dirty white. Head dusky. Dorsal, anal and caudal dusky, marked with black, and several irregular-shaped spots of indistinct blue."

Characterized chiefly by its coloration, the bright blue lower surface of the head apparently diagnostic. It seems to approach *Cichlasoma microphthalmus* (Günther) as figured by Regan, though that species is apparently without any dark tints on the lower surface of the head.

(*Cacruleus* blue + *gula* throat; with reference to the under surface of the head.)

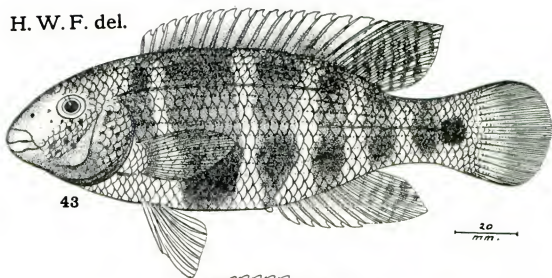
**Cichlasoma guttulatum** (Günther).

#### *Atlantic Specimens*

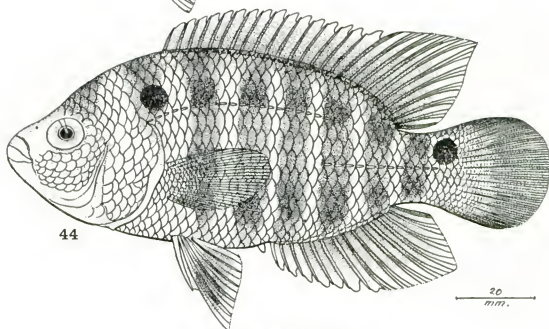
Rio Motagua at El Rancho 1 (51) Feb. 17. "Silvery, with a dusky interrupted line and a black band around base of caudal. Dorsal and anal dusky. Caudal clear, dusky in center."

Small tributary of the Rio Motagua, 20 miles west of El Rancho 1 (80) Feb. 23. "Dusky, with a few peacock blue spots about the head, cheeks and belly. A black line along sides of body, broken by 3 pale bars. Fins red, dotted with very pale blue, except pectorals and ventrals, which are

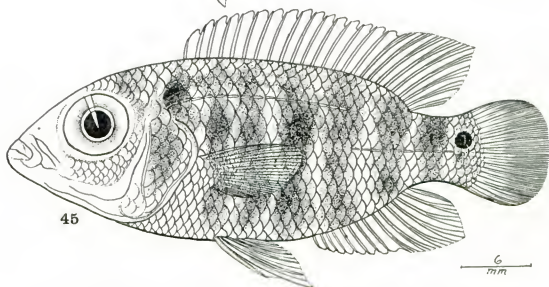
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43

20  
mm.

44

20  
mm.

45

6  
mm.43. *Cichlasoma caeruleogula*. 44, 45. *Cichlasoma gordon-smithi*.

clear." Also 5 (103 to 120), same data. "General color dusky, spotted all over profusely with red. Lower parts of gill covers blue, with irregular red lines. Belly white. Dusky blotches in lateral series. Fins red, speckled with sky blue. Pectoral clear yellow. Ventral dusky yellow." Also 2 (166 to 183), same data. "Region between gills red. Lower part of gills red, marked with oval, pale blue spots. Dusky lateral band sub-inferior and dark basal caudal spot. Lips pale."

Rio Motagua at El Rancho 1 (104) Feb. 24. "Olive green, with 8 lines of deep ochre yellow spots below lateral line. Three dusky markings on first half of body. Head marked with irregular pale blue lines. Lips bluish gray. Belly white. Iris yellow. Dorsal olive, with 2 parallel lines of light blue dots, edged with red. Caudal dusky, with black spot at base. Anal light red, with 3 rows of oblong blue markings. Pectoral yellow. Ventral clear, tinged red terminally."

My materials differ considerably from Günther's figure of *Heros guttatus*, in that the black subinferior lateral band is quite variable, though always distinct and contrasted. Moreover the soft vertical fins of my materials are broadly pale to whitish, leaving the greater basal portion blackish in alcoholic preparations. There are also traces of 5 or 6 indistinct, ill defined, darker vertical bands in some specimens.

#### *Pacific Specimens*

Lake Amatitlan 3 (228 to 243) Feb. 1935. Stream issuing from Lake Amatitlan 22 (48 to 194) March 2.

#### ***Cichlasoma nigrofasciatum* (Günther).**

Lake Atitlan 62 (34 to 78) Jan. 29. "Dusky blackish, with 6 vertical gray green bands. Iris dusky brown. Fins dusky, ends of dorsals and anals dull pink. Caudal pale pink." In alcohol now these all have uniformly dark or gray black eyes, while in Amatitlan material they are pale gray to whitish. Also 151 (30 to 88) Jan. 30, same data.

Stream issuing from Lake Amatitlan 105 (38 to 85) March 2. "Silvery, with 8 vertical bands of round dots, more or less, along whole length of body. Fins clear. Others silvery, darker above. Sides with dark stripe towards tail. Dorsal dusky, caudal bisected by narrow black line, fin otherwise, together with anal and pectoral, orange. Iris white."

#### ***Cichlasoma spilurum* (Günther).**

Tributary of Rio Motagua 20 miles west of El Rancho 1 (113) Feb. 23. "Olive, with 8 vertical black bands. Iris peacock blue. Fins olive, mottled with black, except clear yellow pectoral. Ventral black."

#### ***Cichlasoma aureum* (Günther).**

Rio Motagua at El Rancho 1 (118) Feb. 24. "Pale olive green above, turning to golden a little below lateral line and to white on belly. Head

pale. Head and body sparingly flecked with pale blue all over. Upper lip pale blue, lower white. A dusky spot at lower angle of gill opening. Iris whitish. Dorsal olive, border red on top with white, each ray ending in chestnut brown. Anal yellow, with 2 rows of diagonal, shining, white bars. Caudal olive yellow. Pectorals clear. Ventral rays white, webbing yellow."

***Cichlasoma motaguensis* (Günther).**

Tributary of Rio Motagua, 20 miles west of El Rancho 5 (118 to 282) Feb. 24. Four smaller "dusky, head bluish and marked all over with golden olive. Black blotches along lateral line. Pectoral clear yellow. Ventral dusky yellow. Other fins olive, spotted with brown." Largest specimen with "general color bluish green. Head finely spotted with dark brown. Rest of body spotted with black and dark brown. Top of head greenish black. Dorsal, anal, caudal and ventrals yellowish, spotted thickly with dark brown. Pectoral clear yellow."

***Cichlasoma friedrichstahlii* (Heckel).**

Tributary of Rio Motagua, 20 miles west of El Rancho 154 (114 to 193) Feb. 24. Of these one 144 mm. with "general color dusky, speckled all over with blackish brown. Cheeks peacock blue, speckled with black, with 2 larger black blotches at top and bottom of cheek. Top of head sooty black. Black spot at caudal base. Pectoral clear yellow, rest of fins dusky, speckled with dark brown."

***Cichlasoma gordon-smithi*, new species. Figures 44 (type) and 45 (young).**

Depth  $2\frac{1}{4}$  to  $2\frac{3}{5}$ ; head  $2\frac{3}{5}$  to  $2\frac{3}{4}$ , width  $1\frac{1}{5}$  to 2. Snout 3 to  $3\frac{1}{4}$  in head from snout tip; eye  $3\frac{1}{5}$  to  $3\frac{1}{4}$ ,  $1\frac{1}{5}$  to  $1\frac{1}{4}$  in snout,  $1\frac{1}{5}$  to  $1\frac{1}{4}$  in interorbital; maxillary reaches about  $\frac{7}{8}$  to eye, length  $2\frac{3}{4}$  to 3 in head from snout tip; teeth in jaws simple, conic, in bands, of about 4 or 5 irregular series as counted transversely, with outer row moderately enlarged as 8 above and 10 below anteriorly; no teeth on palate; interorbital  $3\frac{1}{4}$  to  $3\frac{3}{4}$ , rather low, broadly convex; preopercle edge entire. Gill rakers  $3 + 9$ , robust, lanceolate,  $\frac{1}{2}$  of gill filaments, which are  $1\frac{1}{5}$  in eye.

Tubular scales 19 or 20 in upper section of lateral line, 9 or 10 in lower section to caudal base and 1 more on latter; 6 above, 12 below, 13 predorsal forward opposite eye center; 5 or 6 rows on cheek to preopercle ridge. Caudal with small scales basally. Small scales on chest and breast. Scales with 18 short, basal, marginal striae; 55 to 60 short, weak apical denticles, with 4 to 7 transverse series of basal elements; circuli fine, coarse or obsolete apically.

D. XVI, 11, 1 or 12, 1, last spine  $2\frac{1}{5}$  to  $2\frac{3}{5}$  in total length of head, fifth ray  $1\frac{1}{5}$  to  $1\frac{3}{5}$ ; A. VI or VII, 8, 1 or 9, 1, last spine  $2\frac{3}{5}$  to  $2\frac{1}{2}$ , fifth ray  $1\frac{1}{5}$  to  $1\frac{3}{5}$ ; caudal  $1\frac{1}{5}$  to  $1\frac{1}{2}$ , convex behind; least depth of caudal peduncle  $2\frac{3}{5}$ ; pectoral  $1\frac{1}{5}$  to  $1\frac{1}{2}$ , rays 1, 11 to 1, 14; ventral 1, 5, fin  $1\frac{1}{5}$  to  $1\frac{1}{2}$  in total head length.

In alcohol dark gray, scarcely paler on lower surfaces, with 7 darker transverse bands, each greatly wider than paler interspaces. Each of these

bands a little darker along and close above body axis. Above suprascapula rounded blackish spot little smaller than eye and another on caudal at bases of rays of upper half of fin. Iris gray. Fins all more or less gray and pectorals pale. Ventrals blackish gray in front.

A.N.S.P., No. 64153. Small lake at Moco, 3050 feet elevation, at foot of volcano of Atitlan. March 3, 1935. Length 143 mm. Type. Also No. 64154, same data, paratype. Length 130 mm. When fresh the type was with "General color olive yellow, turning to orange on belly. Iris orange. Black spot on each side of upper part of back of head. Flanks marked with blackish brown bars. Caudal yellow. Caudal spot black, surrounded by clear yellow."

Besides the above two young examples with the same data, 23 and 25 mm. long. "Dusky, barred with 6 pale bands and 2 black spots, one on middle of side and other above at caudal base. Iris orange. Fins clear."

Apparently unique in its coloration and combination of structural characters.

(For Mr. Gordon Smith of the "Finca Mocá", in appreciation of his interest in the natural history of Guatemala.)

#### GOBIIDAE

*Chonophorus taiaisa* (Lichtenstein).

Rio Motagua at El Rancho 1 (193) Feb. 17. "Dull yellowish, speckled and marked with black above. Top of head blackish, marked and lined with black. Entire under parts, ventral and anal fins white. Upper lip dull bluish, lower white. Both dorsals and caudal marked with black longitudinal spots, forming parallel bars. Pectoral white. Ventral with radiating dusky lines."

#### FAUNAL WORKS

BLEEKER, PIETER, 1863. Sur deux nouvelles espèces de *Citharichthys* de Suriname et de Guatemala. Verslag. Kon. Akad. Wet. Amsterdam, vol. 15, pp. 452 to 455; Nederl. Tyds. Dierk., vol. 2, pp. 73 and 74. *Citharichthys guatemalensis* described.

GÜNTHER, ALBERT, 1864. Report on a collection of fishes made by Messrs. Dow, Godman and Salvin in Guatemala. Proc. Zool. Soc. London, 1864, pp. 144 to 154. Describes *Centropomus medius*, *C. nigrescens*, *C. brevis* (tropical America), *Mesoprius aratus*, *Pristipoma macracanthum*, *P. leuciscus*, *Conodon pacifici*, *Umbrina elongata*, *Micropogon altipinnis*, *Otolithus albus*, *O. reticulatus*, *Atherinichthys guatemalensis*, *Gerres axillaris*, *G. brevimanus*, *Heros guttulatus*, *H. macracanthus*.

——— 1866. [On the fishes of the states of Central America, founded upon specimens collected in the fresh and marine waters of various parts of the country by Messrs. Salvin, Godman and Capt. J. M. Dow.] Proc. Zool. Soc. London, 1866, pp. 600 to 604. Describes *Heros nigrofasciatus*, *H. lobochilus*, *H. trimaculatus*, *H. motaguensis*, *H. oblongus*, *Melitta petenensis*.

——— 1869. An account of the Fishes of the States of Central America, based on collections made by Capt. J. M. Dow, F. Godman, Esq., and O. Salvin, Esq. Trans. Zool. Soc. London, vol. 6, pp. 377 to 494, pls. 63 to 87. Of 300 species listed but 50 were reported from Guatemala.

HUBBS, CARL L., 1935. Fresh-water Fishes collected in British Honduras and Guatemala. Univ. Michigan Miscell. Publ., No. 28, pp. 1 to 22, pls. 1 to 3, 1 map. Describes *Rhamdia guatemalensis muriei*, *Mollienisia sphenops vantynei*, *M. s. macrura*, *Cichlasoma synspilum*, *C. hyorhynchum*, *C. urophthalmus trispilum*, in a list of 18 species and subspecies.

MEEK, SETH EUGENE, 1906. Description of three new species of fishes from Middle America. Field Columbian Mus. Publ., Zool., vol. 7, No. 3, pp. 91 to 95. *Rhamdia cabreræ* and *Cichlasoma centrale* described from Guatemala.

——— 1907. Notes on fresh-water fishes from Mexico and Central America. *Loc. cit.*, vol. 7, No. 5, pp. 133 to 157. List of 30 species from Guatemala, of which *Cichlasoma milleri* from El Rancho described as new.

——— 1908. The Zoology of lakes Amatitlan and Atitlan, Guatemala, with special reference to ichthyology. *Loc. cit.*, vol. 7, No. 6, pp. 159 to 206. On pp. 183 to 191 list of 7 species.

MILLER, NEWTON, 1907. The fishes of the Motagua River, Guatemala. Bull. Amer. Mus. Nat. Hist., New York, vol. 23, pp. 95 to 123, figs. 1 to 6. Describes *Poecilia amates*, *Thyrina meeki*, *Cichlasoma globosum*, *C. maniana*, and *C. acutum*, included in a list of 32 species.

STEINDACHNER, FRANZ, 1864. Beiträge zur Kenntniss der Chromiden Mexicos und Central Amerikas. Denkschr. Akad. Wiss. Wien, vol. 23, Abth. 2, 1864, pp. 57 to 74, pls. 1 to 5. Describes *Heros triagramma* and *H. melanopogon* as new, and *H. urophthalmus* Günther; also *Petenia splendida* Günther, all without definite locality other than Central America.

## NOTES ON AMERICAN MABUYAS

BY EMMETT REID DUNN.

The following notes are the result of an attempt to name *Mabuya*s from the islands of St. Martin, Redonda, and Marie Galante, in the collection of this Academy. Each island of the Lesser Antilles was supposed to have a single endemic species of *Mabuya*, but it soon became apparent that the specimen from Marie Galante (in the middle of the chain) was indistinguishable from certain mainland specimens, and investigation was directed to the entire group of American *Mabuya*.

In another connection I have seen a large number of *Mabuya* from Nicaragua, Costa Rica, and Panamá, in many museums. In this study I have examined the entire collection of this Academy and of the U. S. National Museum. I have seen the entire South American collection of the Museum of Comparative Zoölogy, the Field Museum, and of the Carnegie Museum. The University of Michigan Museum has loaned me their series from Bolivia. I have examined the more important specimens in the American Museum of Natural History. Specimens from Martinique, from St. Vincent, and from Old Providence, have been loaned me by the Museum of Comparative Zoölogy, and the Carnegie Museum has loaned me one from Trinidad. I wish to express my thanks to the authorities of these institutions. I am indebted to Miss Doris Cochran for permission to use her notes on the type of *nitida* from Hispaniola, and to Mr. Arthur Loveridge for notes on the type of *luciae*. For aid in a very complicated nomenclatorial situation I wish to thank Dr. Stejneger.

The material examined is not adequate to settle all the problems which have arisen, and, since the animals have been killed off by the mongoose on many islands, some will never be settled. It takes only a few specimens to show that two supposed species are not really distinct, but large numbers are often necessary to show whether or not two populations should be accorded different racial rank. The material of over 375 specimens which I have seen, while sufficient to show that many forms are invalid as species, leaves their racial status in some doubt.

I have considered all characters which my predecessors on *Mabuya* have used. These characters are in all probability hereditary. There is scarcely a character which, in one population or another, is not subject to individual variation. No population of *Mabuya* is characterized by complete uniformity of hereditary traits. The same tendencies may appear in widely separated populations, while neighboring populations may be quite different.



In this situation I am inclined to give taxonomic recognition only to those populations over 75% of which can be distinguished from members of any other population. The really embarrassing problems arise in connection with the races of *Mabuya mabouya*, especially with the insular populations.

This paper is in no sense a monograph, since I make no pretense to having made a complete survey of the existing material or the literature, but these notes are based on the examination of more material than any previous treatment of the American species.

#### MABUYA Fitzinger

1826 *Mabuya* Fitzinger, Neue Class. Rept., p. 23. Type, by virtual tautonymy, *Lacertus mabouya* Lacépède, cited on p. 52 in synonymy of *M. dominicensis* Fitzinger.

1826 *Spondylurus* Fitzinger, t.c., p. 23. Monotype *Scincus sloanii* Daudin.

1845 *Copeoglossum* Tschudi, Vers. Fauna Peruana, Herp. p. 45. Monotype *C. cinc-tum* Tschudi.

1845 *Mabouya* Gray, Cat. Lizards Brit. Mus., p. 93. Emendation.

1862 *Mabuia* Cope, Proc. Acad. Nat. Sci. Philadelphia, p. 185. Emendation.

Gray (1845, l.c.), as first reviser, chose between *Mabuya* and *Spondylurus*. The preceding synonymy includes only names based on American species.

*Range:* From the states of Colima and Vera Cruz in Mexico, West Caicos in the Bahamas, and Jamaica, to Patagonia and the Province of Cautin in Chile. Island of Fernando do Noronha.

*Remarks:* The nine species and eleven races into which the American forms of *Mabuya* may be divided all agree in the following characters: lower eyelid with a transparent disk; a postnasal; one ordinary subocular; subdigital lamellae smooth; scales on foot not spinose. These characters, especially the first, link the American forms with African *Mabuyas* rather than with those of Eastern Asia and Malaya. The nearest relationship of the mainland and Caribbean forms seems to be with the mainland African species of the *raddonii-affinis* group. The Fernando Noronha species seems more like those of the Cape Verde Islands.

On the mainland and on the Caribbean islands those which have a single pair of nuchals, two frontoparietals, four supraoculars, long legs, and only a single dark stripe on each side are more like their African congeners. *Mabuya mabouya mabouya* thus seems the most primitive form, while the others seem specialized in one way or another.

#### Key to American forms of *Mabuya*

- A. Auricular denticles present; scales strongly keeled, in 38-40 rows; no trace of longitudinal striping; Island of Fernando Noronha . . . *punctata*.
- AA. No auricular denticles; scales smooth or very feebly keeled, in 26-34 rows; at least a trace of longitudinal striping.

B. Pale, with small dark dots; trace of black stripe from lip to shoulder; snout and tail elongate; Old Providence Island.

*pergravis*.

BB. At least one lateral stripe well marked unless color is very dark; never pale with dark dots.

C. Two frontoparietals.

D. Appressed legs overlapping, meeting or barely separated; dark stripes not more than seven.

E. No middorsal dark stripe on body or tail; normally four supraoculars.

F. Normally one pair of nuchals; normally no dorsolateral dark stripes; never as below in FF; Mexico to Ecuador, Brazil, and Lesser Antilles .....*mabouya mabouya*.

FF. More than one pair of nuchals and a pair of dorsolateral dark stripes; Bahamas and Jamaica to the Virgin Islands.

*mabouya sloanii*.

EE. A middorsal dark stripe on body; dorsolateral dark stripes converge to form a middorsal dark stripe on tail; three supraoculars; Paraguay and Brazil to Argentina .....*dorsovittata*.

DD. Appressed legs well separated; nine to ten dark lines.

E. Appressed legs separated by half the length of the hind leg; scales in 30-32 rows; nine dark stripes at level of axilla; Bolivia and Matto Grosso.

*guaporicola*.

EE. Appressed legs separated by the length of the hind leg; scales in 26 rows; ten dark stripes on body; tail blue; Hispaniola .....*lineolata*.

CC. One frontoparietal.

D. No middorsal light stripe.

E. Supraoculars four; no middorsal dark stripe; legs long; Matto Grosso, Bolivia, Paraguay, Argentina, Chile .....*frenata frenata*.

EE. Supraoculars three; a middorsal dark stripe; legs short; interior of Bolivia ...*frenata cochabambae*.

DD. A middorsal light stripe.

E. One pair of nuchals; dark with three light stripes; west coast of Peru .....*deserticola*.

EE. Normally three pair of nuchals; dark with five light stripes; Bolivia, upper Amazon and Venezuela .....*nigropalmata*.

**Mabuya punctata** (Gray).

1838 *Tiliqua punctata* Gray, Ann. Nat. Hist. 2, p. 289.

1887 *Mabuia punctata* Boulenger, Cat. Lizards Brit. Mus. Nat. Hist. (2), 3, p. 160, pl. 9, f. 1.

*Type*: Not examined (in British Museum).

*Type locality*: Island of Fernando Noronha, in Atlantic about 200 miles east of Cape São Roque, Brazil.

*Range*: Known only from type locality.

*Diagnosis*: Distinguished from all other American *Mabuya* by having auricular denticles; scales heavily keeled, in 38-40 rows.

*Description*: (drawn from M.C.Z. 28676 and A.M.N.H. 5227-9) Supra-nasals in contact; prefrontals broadly in contact; two frontoparietals; parietals in contact; one pair of nuchals; supraoculars 4, anterior in contact with frontal; eye over 5th or 6th labial, in equal numbers; scales 38 in A.M.N.H. 5227, 39 in A.M.N.H. 5228 and M.C.Z. 28676, 40 in A.M.N.H. 5229; dorsal scales with three well-developed keels; scales from chin to vent 68 in M.C.Z. 28676 and A.M.N.H. 5228; legs well developed, overlapping when appressed; 3-5 well-developed denticles anterior to ear opening; above mottled dark brown, black, and yellow, each scale being more or less tricolor; yellowish below; no indication of striping; eyelids white; nothing distinctive about size or proportions.

*Remarks*: Judging from the remarks in Boulenger (*l.c.*) this species is more similar to certain African forms than to any other American forms, and especially to insular African species. Such high scale counts are met with (among otherwise similar *Mabuya*) only in the Cape Verdes, the Comoros, and the Seychelles.

Boulenger, after examination of the types, considers that *maculata* Gray from Demerara is a synonym of *punctata*. The types of the former were said to be in bad condition. I am inclined to doubt the propriety of this arrangement, and believe that the lower counts which he gives for the scale rows of *punctata* (34) are derived from the inclusion of mainland specimens.

He also includes under *punctata* the type of *Mabouya punctatissima* O'Shaughnessy (1847, Ann. Mag. Nat. Hist. (4), 13, p. 300), which was described as having 42 scales, and, with a query, as from the Cape of Good Hope. I am unable to comment on the propriety of this action.

In many ways the specimens seen by me from Fernando Noronha are abundantly distinct from all other American *Mabuya*. This is the only American form with ear denticles, heavily keeled scales (more than 34 scale rows), and without a trace of striping.

***Mabuya pergravis* Barbour.**

1921 *Mabuya pergravis* Barbour, Proc. New England Zool. Club 7, p. 85.

*Type*: U.S.N.M. No. 13875.

*Type locality*: Old Providence Island, in the Caribbean.

*Range*: Known only from type locality.

*Diagnosis*: Similar in scalation to *M. mabouya*; snout long; tail long; striping very indistinct; pale, with dark dots above.

*Description:* The type, three paratypes, and a more recent specimen have been examined (U.S.N.M. 13875, 63394-5, M.C.Z. 14294, U.S.N.M. 78947). All have the supranasals in contact and the prefrontals separate. U.S.N.M. 63394 has a single frontoparietal, and the rest have two. The parietals are in contact in all save U.S.N.M. 63395. There is a single pair of nuchals in all except M.C.Z. 14294, which has two nuchals on the right side. The supraoculars are four, with the anterior small, except in U.S.N.M. 63394, which has three on the right side, and U.S.N.M. 63395, which has three on both sides. The eye is over the sixth labial in two specimens (U.S.N.M. 13875, 63395). In the other three it is over the sixth on one side and over the fifth on the other. The scale rows number 28 in U.S.N.M. 63394 and 78947; 30 in the other three. The scales from chin to vent are, in the order of specimens first given: 66, 66, 72, 64, 65. The snout is noticeably long in comparison with specimens of *M. mabouya*. The tail is longer than the average in *M. mabouya*; in M.C.Z. 14294 the length of head and body is 81 mm.; the tail measures 163 mm. The ground color is a pale yellowish brown, lighter below. The lateral stripes of *M. mabouya* are indicated by a short, ill-defined, dark shade from eye to past the shoulder. There are numerous small black dots on the dorsal surface.

*Remarks:* The extraordinary variation in scalation in a small population represented by five specimens comes close to covering the entire variational range of *M. mabouya* and its races. At the same time they are all alike in coloration and are unlike any *M. mabouya* seen. The lateral striping is often indistinct in specimens of *M. mabouya*, but only in those in which the ground color is very dark. The ground color in *M. pergravis* is lighter than in any *M. mabouya* save some from Central America and Brazil. It is on account of the coloration that I regard *pergravis* as distinct from *mabouya*, to which it is closely related and from which it has probably been derived.

**Mabuya mabouya** (Lacépède).

The range, variations and characters of *Mabuya mabouya* have been derived from examination of the specimens and the reports in literature detailed in the following list:

BAHAMA: West Caicos (U.S.N.M. 81448), Turk's I. (A.N.S. 3835), Grand Turk (Barbour 1919, Proc. Biol. Soc. Washington 29, p. 219, states the color and the condition of the supranasals of two specimens).

JAMAICA: U.S.N.M. 5759 (six spec.), A.N.S. 9404-9, A.N.S. 13597-9, Bocourt 1879 (Miss. Sci. Mex. pl. 22B, f. 4 (head scales)). All apparently cotypes of *fulgida*.

HISPANIOLA: Miss Cochran has kindly allowed me to use her notes and photograph of M.C.Z. 3617, a cotype of *nitida*.

MONA: Stejneger 1904, Rep. U.S.N.M. 1902, p. 608, records the supranasals of four specimens; Boulenger 1894-6 (Jahr. Nat. Ver. Magdeburg) records the suboculars, supranasals and scales of two specimens; Schmidt 1920 (Ann. New York Ac. Sci. p. 104) records the scale rows of a specimen; and Schmidt 1926 (Pub. Field Mus. Zool. 12, p. 156) records the scale rows and ventrals of two specimens.

PORTO RICO: Garman 1887 (Bull. Essex Inst. 19, p. 51) gives characters of three cotypes of *nitida*; Stejneger 1904 (*l.c.*) gives characters of M.C.Z. 6052 (a cotype of *nitida*); Schmidt 1920 (*l.c.*) gives the dorsal scales of three specimens; A.N.S. 9401 from "West Indies" is probably a Porto Rico specimen.

MONA and CULEBRA: Grant 1931 (Journ. Dept. Agric. Porto Rico 15, 3, p. 217) gives the nuchal count for 60 specimens and the supranasal situation for 61. He also figures the coloration from these islands.

MONA, PORTO RICO, and CULEBRA: Schmidt 1920 (*l.c.*) gives the supra-ocular situation for seven specimens from these islands. Schmidt 1928 (New York Ac. Sci. Surv. Porto Rico 10, 1, pl. 121) gives the nuchal and supranasal situation for the same seven specimens.

HICACOS I. near Porto Rico: Grant 1932 (*t.c.* 16, 2, p. 162) gives the coloration on this island.

VIEQUES: Mabuya is reported from this island by Reinhardt and Lütken (1863, Vid. Meddel. Nat. For. 1862, p. 229). on the authority of Rüse. No details.

CULEBRA: U.S.N.M. 49586; Schmidt 1920 (*l.c.*) gives the scale rows of three specimens.

LUIS PEÑA KEY, near Culebra: Grant 1931 (*l.c.*) gives the coloration from this island.

VIRGIN I.: A.N.S. 19626.

ST. THOMAS: The original descriptions of *sloanii* and of *cuprescens*; Bocourt (*l.c.*, pl. 22B f. 3b) shows the head scalation of the type of *sloanii*; in f. 3a, 3c, he figures the head scales of another specimen from St. Thomas.

BUCK I. near St. THOMAS: Grant 1932 (*l.c.*) gives the coloration from this island.

JUST VAN DYCK: Reinhardt and Lütken record *Mabuya* from this island with no details.

SALT I. near TORTOLA: Grant 1932 (*t.c.* 16, 3, p. 344) records *Mabuya* from this island with no details.

ST. JOHN: Reinhardt and Lütken (*l.c.*) record *Mabuya* from this island with no details.

ST. CROIX: Günther 1859 (Ann. Mag. Nat. Hist. (3) 4, p. 212) records *Mabuya* from this island with no details.

Stejneger 1904 (*l.c.*) gives characters of the types of *spilonota* and of *semitaeniata*. Both are without locality, but both are quite obviously from the northern Antilles.

ST. MARTIN: A.N.S. 9503-7, 9514-5.

REDONDA: A.N.S. 9517.

MONTSERRAT: U.S.N.M. 30850.

GUADELOUPE: U.S.N.M. 11249 (three spec.), 11175.

MARIE GALANTE: A.N.S. 9513.

DOMINICA: U.S.N.M. 10149, 11046; the description of *dominicana*; Günther 1888 (Ann. Mag. Nat. Hist. (6) 2, p. 364) gives some scale details of fourteen specimens.

MARTINIQUE: M.C.Z. 6047, 6048 (two spec.), 6010. Bocourt (*l.c.*) figures the head of the type of *metallica* (pl. 22B, f. 1), and the head of a specimen from "Martinique or Guadeloupe" (pl. 22B, f. 5).

STA. LUCIA: The description of *luciae* (with notes on the type, M.C.Z. 6046, kindly furnished me by Mr. Loveridge); the information on four specimens in Boulenger (1891, Proc. Zool. Soc. London, p. 355).

ST. VINCENT: M.C.Z. 6040 (three specimens); Boulenger (1891, *l.c.*) gives information about three specimens.

PETIT MARTINIQUE: U.S.N.M. 79131.

GRENADA: U.S.N.M. 72658-9.

TOBAGO: Barbour (1916, Proc. Biol. Soc. Washington 29, p. 223) records *Mabuya* from this island without details.

TRINIDAD: A.M.N.H. 1610, Carn. 6565.

BARBADOS: U.S.N.M. 6041. The two types of *lanceolata*.

MEXICO: No locality: A.N.S. 9415, A.M.N.H. 19282-6; Mexico City [??] U.S.N.M. 12718; Colima, U.S.N.M. 31528; Orizaba, U.S.N.M. 12517; Acozcuintla, Chiapas, U.S.N.M. 47138; Chiehen Itza, A.M.N.H. 38863-5.

CENTRAL AMERICA: U.S.N.M. 61281-6; head scales figured by Bocourt (*l.c.*, pl. 22B, f. 6).

GUATEMALA: Sacluc, Peten, U.S.N.M. 62968.

HONDURAS: Belize, U.S.N.M. 31337, 25447, 26074, 58161-2. Lancetilla, A.N.S. (two specimens); Patuca, U.S.N.M. 20307-9; Carmellina, U.S.N.M. 20306.

NICARAGUA: San Ramon, B.M.N.H.; Comoapa, M.C.Z. 9520; Polvon, M.C.Z. 3807 (three specimens), 5774; Maselina Cr. A.M.N.H. 16412; Mo. Rio Grande, A.M.N.H. 16413-4; Cody Plant., A.M.N.H. 16415-6; Cukra, A.M.N.H. 16417, 16419, 16421; Kanawa, A.M.N.H. 16418, 16422; Whole-some Cr., A.M.N.H. 16420; Prinzapolka, A.M.N.H. 16423; San Carlos, A.M.N.H. 16424; Tuli Cr., A.M.N.H. 16425; 16 mi. up Escondido R., U.S.N.M. 19873; 50 mi. up Escondido, U.S.N.M. 19872; no locality, U.S. N.M. 16145.

COSTA RICA: Turrialba, M.N.C.R.; San Jose, Frankfort; Candelaria, M.C.Z. 19826; Santo Domingo, U.S.N.M. 36697-8; Tivives, U.S.N.M. 36996; Guapiles, M.C.Z. 15441-2, 18912; El General, A.M.N.H. 16291-2; Monteverde, M.C.Z. 15462-3; Zent, M.C.Z. 15389-93; Colorado Jet., U.S.N.M. 19542; Sta. Cecilia, M.C.Z. 19826; Talamanca, M.C.Z. 19827-34; "the low country" U.S.N.M. 30619-20 (types of *alliacea*). Cope (1875, Journ. Acad. Nat. Sci. Philadelphia (2) 8, p. 116), records *Mabuya* from Sipurio with no details. Wettstein (1934, Sitz. Ak. Wiss. Wien, I, 143, p. 22) gives some details concerning two specimens from Siquirres and from Hamburg Farm.

PANAMÁ: Bocas, U.S.N.M. 58160; Punta de Peña, U.S.N.M. 38690-2; Almirante, M.C.Z. 19832-5; Boquete, Mich.; Rabo de Puerco, Mich.; Chiriqui, Berlin, Vienna; Remedios, A.M.N.H. 28393; San Miguel I., M.C.Z. 9887-93; Gatun, M.C.Z. 19837; Ft. Randolph, M.C.Z. 19845, 18894-7; France Field, M.C.Z. 18910-1, 19846-8; San Pablo, M.C.Z. 3935; Barro Colorado Island, M.C.Z. 22293, 29382; Ft. Sherman, M.C.Z. 19850-1; Las Cascadas, M.C.Z. 19836; Largo Remo Isl., M.C.Z. 19838-44; Ft. Clayton, M.C.Z. 20606-7; Aneon, M.C.Z. 16347, 18901, 32060-1, U.S.N.M. 50398; Bruja Pt., M.C.Z. 29329; Caledonia, A.M.N.H. 37856; Cana, 200 ft., U.S. N.M. 50133; Yavisa, M.C.Z.; Chucunaque, A.M.N.H. 37901; Canal Zone, U.S.N.M. 54322. The description of the type of *unimarginata*.

COLOMBIA: Andagoya, M.C.Z. 29684; Tolima, M.C.Z. 15938-40; Medellin, M.C.Z. 15160; Honda, M.C.Z. 21972; Rio Frio, M.C.Z. 29726; Bogota, M.C.Z. 19295; No locality, A.N.S. 9414.

VENEZUELA: El Limon, Distrito Federal, Carn. 7326; Colonia Tovar, Est. Aragua, 2000 ft., Carn. 7367; Tovar, 6000 ft., Carn. 7368-70, 7372-87, 7389, 7391-2; Cariquito, A.N.S. 18279; Est. Sucre, Hac. San Rafael, nr. Cumanacoa, Carn. 7831, 7833-4, 7844, 7871, 7920; Cumanacoa, M.C.Z. 15715; Est. Sucre, Hac. Mirasol, nr. Latel, Carn. 7960; Est. Sucre, Elvecia, Mt. Turumiquire, 1700 m., Carn. 7985; Mt. Turumiquire, 1730 m., Carn. 7997.

ECUADOR: Baños-Canelos, A. M. N. H. 37863. Boulenger (1887, Cat. Lizards Brit. Mus. (2), 3, p. 191) records it as *agilis* from Pallatanga, 5000 ft., the most southern locality on the Pacific side.

PERU: Ambiacu R. (Hauxwell), A.N.S. 9511-12; no locality (Hauxwell), A.N.S. 9509-10. The description of *cinctum*. Boulenger (*l.c.*, p. 190) records it from Moyabamba, Cayaria, and Puerto del Mairo.

GUIANA: Surinam, A.N.S. 9532-3, U.S.N.M. 11042-3, 11048; Paramaribo, U.S.N.M. 9681; British Guiana, Carn. 5370. The description of *surinamensis*. Bocourt (*l.c.*) figures the heads of three Guiana specimens in his pl. 22A, f. 2; 22B, f. 2; 22C, f. 3.

BRAZIL: Cucuihy, Rio Negro, U.S.N.M. 80688; Santarem, M.C.Z. 1160; Obidos, M.C.Z. 1226; Hyutaihan, lower Amazon, U.S.N.M. 28950; Lago Alexi (Thayer Exped.) A.N.S. 14409; the descriptions of *bistriatus* and *nigropunctatus* by Peters (1877, Mon. Ac. Berlin, p. 412); Goyaz, M.C.Z. 4249; Rio de Janeiro, M.C.Z. 3323; upper Pernahyba, A.N.S. 30683; Santos to São Paulo, A.N.S. 9508; São Paulo, A.M.N.H. 7698; Caxias, near Rio, U.S.N.M. (two); Therezopolis, U.S.N.M. (two); Chapada, A.N.S. 12963, 12965, 12967; Lake Gahiba-Mirim, Field 9151; Urucum, nr. Corumba, Field 9186, 9221, 9225, 9236, 9244; São Antonio de Guapore, Carn. 961.

BOLIVIA: Tumupasa, A.M.N.H. 22460; "interior", A.M.N.H. 1680; Buenavista, Mich. 60622, 63792, 60579-80; Dept. Sta. Cruz, Mich. 68100 (four), 68101 (three), 68102 (three), 68103.

"SOUTH AMERICA": A.N.S. 9403.

#### *Variation in Mabuya mabouya*

*The supranasals.* The extreme conditions are: Jamaica and the Bahamas, no cases of contact known; Guiana and the Amazon Valley, all specimens known have these scales in contact. Less extreme conditions are: St. Vincent to Trinidad, 15% contact; Mexico, 33% contact; St. Martin to Sta. Lucia, 34% contact; eastern Venezuela, 45% contact; Matto Grosso, 50% contact; southeastern Brazil, 62% contact; Hispaniola to the Virgins, 69% contact; Central America, 75% contact; Bolivia, 76% contact; western Venezuela, 92% contact; Colombia, 98% contact.

*The prefrontals.* In most parts of the range these are rarely in contact, but on Sta. Lucia three of the five known specimens (60%), and in Bolivia ten out of seventeen (app. 59%) have them in contact. They are not in contact in any known specimens from Mexico, Guiana, or the Amazon valley.

*The parietals.* These scales are in contact in all known specimens from Mexico, from Southeastern Brazil, and from Hispaniola to the Virgins. They

are in contact in only 9% of the Guiana specimens (Bocourt 1879, pl. 22B, f. 2) and in only 20% of the Matto Grosso specimens (Field 9151, 9221). Specimens from eastern Venezuela and from St. Vincent to Trinidad have 50% parietal contact. Elsewhere (Central America, the other Antilles, Colombia, western Venezuela, the Amazon valley, and Bolivia) a strong majority have the parietals in contact.

*The nuchals.* The nuchals are never more than a single pair anywhere on the mainland. In Sta. Lucia all known specimens have two or three. In St. Martin 71% have a single pair, the rest having two or three. From Jamaica and the Bahamas to the Virgins a large majority have more than one pair, as follows:

	one	two	three
Bahamas .....	25%	75%	0
Jamaica .....	6%	48%	45%
Hispaniola to Virgins .....	14%	77%	9%

*The supraoculars.* These scales are usually four in number. Three are known from Mexico (A.M.N.H. 19285, 4-3; A.M.N.H. 19286, 3-3), the Amazon Valley (type of *cinctum* from eastern Peru, 3-3; type of *nigropunctatus* from Egea, 3-3), Bolivia (Tumupasa, A.M.N.H. 22460, 4-3; Buenavista, Mich. 63792, 3-?), Porto Rico ("sometimes three" Garman 1887), Mona-Porto Rico-Culebra (3-4 in one of seven specimens, Schmidt 1920). In the islands from St. Martin to Martinique some 73% have three supraoculars. This figure is derived from 22 specimens from seven different islands.

St. Martin: five with 3-3, one with 3-4, one with 4-4.

Redonda: one with 4-4.

Montserrat: one with 3-3.

Guadeloupe: four with 3-3.

Marie Galante: one with 4-4.

Dominica: one with 3-4, one with 4-4.

Martinique: four with 3-3, one with 4-4.

"Guadeloupe or Martinique": one with 4-4.

*The subocular.* The eye is over the fifth, the sixth, or, very rarely, the seventh labial. Boulenger (1894-6) says "over sixth or seventh" of two Mona specimens. Carnegie 7326, from El Limon, Venezuela, has the eye over the sixth on the left side and over the seventh on the right. Peters (1877) states that in the two types of *bistriatus* from Para the subocular is the sixth or the seventh labial. The percentage having the eye over the fifth labial is high in Mexico (96%), Colombia (89%), Bolivia (86%), and Central America (83%). It is low in Matto Grosso (15%), western Venezuela (25%), eastern Brazil (28%), the northern Antilles (29%), and Guiana (32%). Elsewhere the ratio is more nearly even.



*The body scales.* These range from 27 to 34 longitudinal rows. M.C.Z. 6048a and M.C.Z. 6010, both from Martinique, are the only specimens known with 27. Only a single specimen with 34 scales is known from the mainland (Field 9225 from Matto Grosso).

	under 30	30-32	over 32
Mexico and Cent. Amer. ....	53%	47%	0
S. Amer. and Islands to Marie Galante .....	21%	77%	1%
Guadeloupe to Jamaica and Bahamas .....	4%	78%	24%

Faint traces of triple keels can be made out on a number of specimens from Darien, South America, and the southern Antilles. These are often so faint that their presence or absence is a matter of opinion. They are perhaps most noticeable in specimens from Guiana.

*The scales from chin to vent.* These number from 48-72. The mainland extremes are 51-67, and are found in Mexico and Central America. The lowest scale count, 48, is from Jamaica (U.S.N.M. 5759e). On this island the range of fifteen specimens is 48-60, with an average of 56.3. Other low averages are from Central America (nine specimens, range 51-60, average 56.5); Colombia (nine specimens, range 53-64, average 58.3); eastern Venezuela (ten specimens, range 53-62, average 56.6); Guiana (four specimens, range 55-59, average 56); Amazon valley (nine specimens, range 53-61, average 56.6); Matto Grosso (eight specimens, range 52-62, average 57.35). The highest count, 72, is from Dominica (by German 1887). Eighteen specimens from this island give a range of 57-72, and an average of 63.55. The highest averages come from Dominica, St. Martin (seven specimens, range 59-67, average 63.7), Sta. Lucia (five specimens, range 59-69, average 64.2), and Martinique (four specimens, range 62-71, average 65.25).

*The anals.* U.S.N.M. 30619-20, from lower Costa Rica, types of *alliacca* Cope, were described as having enlarged and few anals. This is not correct. They do not differ in this respect from other *mabouya*. All *mabouya* have the median anals more or less larger than the lateral; all have about eight scales bordering the vent anteriorly. In some the median scales are more enlarged than in others, but this has no useful taxonomic or geographical significance as the character is too much a matter of opinion to be trustworthy.

*Proportions.* In the majority of specimens the toes overlap when the legs are appressed, but in the Barbados specimens, the Montserrat specimen, U.S.N.M. 31528 from Colima, Carnegie 7920 from Venezuela, and A.N.S. 9514-5 from St. Martin the toes fail to meet or just touch. The Montserrat and the Venezuela specimens are large, while the others are small.

The tail is ordinarily not much longer than the head and body. An especially long tailed specimen is M.C.Z. 15715, from Cumanacoa, Venezuela, which has a head and body length of 83 mm., tail 147 mm.

*Coloration.* The most widespread and normal pattern is that of a dark lateral stripe, bordered above and below by narrower light lines. More or less dorsal spotting or striping may occur, and is often more pronounced in adults than in young. The normal pattern may be very obscure, especially in old individuals. The rather small types of *lanceolata* from Barbados have a very obscure and almost uniform dark color, but this may be due to preservation. In light specimens the upper light line may be indistinguishable from the light dorsum. This is true of nearly all Mexican specimens, and also of most specimens from the lower Amazon. The name *unimarginata* (type lost) seems to have been based on a Panamanian specimen with this coloration.

Dark marking on the dorsum may take the form of dorsolateral lines from the head to the base of the tail. This coloration is found in specimens from southeastern Brazil, eastern Costa Rica, and the northern Antilles. Eight specimens from the states of Rio de Janeiro and São Paulo (more or less topotypes of *agilis*) include two with well-marked dorsolateral dark lines (from Rio and from Santos-São Paulo), two with faint dark lines (from upper Pernahyba and from São Paulo), and four with the normal coloration (from Therezopolis and Caxias).

Specimens from Colorado Junction, Guapiles, Monteverde, Zent, "low country" (the types of *alliacea*), Talamanca, Almirante, and Bocas del Toro show dark dorsolateral lines. Specimens from Punta de Peña show traces of them. Specimens from Guapiles, Siquirres, Sta. Cecilia, and Almirante lack these lines. Thus, of 29 specimens from this area, approximately 70% have the dorsolateral lines well developed.

All Antillean specimens of *mabouya* from St. Martin north have dorsolateral dark lines. In some the stripe is absent on the head and narrow on the body, not involving the two middorsal scale rows, and is similar to the mainland coloration of this type. This coloration is figured by Schmidt (1928, f. 38A, 39). In some the stripe extends onto the head, and is wider, involving half of each of the middorsal scale rows (Schmidt *l.c.*, f. 38B).

The narrow dorsolateral stripe is found in specimens from the Bahamas, Jamaica, Porto Rico, Hicacos I. near Porto Rico, and St. Martin. It is present in the type of *spilonota*, of unknown provenance. The broad dorsolateral stripe is found in specimens from Hispaniola, Mona, Culebra, Luis Peña Key near Culebra, St. Thomas, Buck I. near St. Thomas, and in the type of *semitaeniatus* without locality.

A synthesis of this variation indicates that the first and most obvious division of this species would divide it into two groups: one for the Northern Antilles (*sloanii*) with more than one pair of nuchals, and with dorsolateral dark stripes; and one for the Southern Antilles and the mainland (*mabouya*) with one pair of nuchals or without dorsolateral dark stripes.

Further discussion will be found under these two headings.

**Mabuya mabouya mabouya** (Lacépède).

- 1788 *Lacertus Mabouya* Lacépède, Hist. Nat. Quad. Ovip. 2, p. 378, pl. 24, chart, in part.
- 1788 *Lacertus auratus* Lacépède, *t.c.*, p. 384, pl. 25, chart, in part (not *Lacerta aurata* Linné).
- 1820 *Scincus cepedii* Merrem, Vers. Syst. Amphib., p. 71 (substitute name for *auratus* Lacépède).
- 1823 *Scincus agilis* Raddi, Mem. Soc. Ital. Modena, 19, 18, p. 62 (type?; Rio de Janeiro).
- 1825 *Scincus bistratus* Spix, Spec. Nov. Lacert. Bras. p. 23, pl. 26, f. 1 (types in Munich, from Para, *fide* Peters 1877, Mon. Ak. Berlin, p. 412).
- 1825 *Scincus nigropunctatus* Spix, *t.c.*, p. 24, pl. 26, f. 2 (type in Munich; Egá [= Tefel]).
- 1826 *Mabuya dominicensis* Fitzinger, Neue Class. Rept. p. 23 (*nomen nudum* or substitute name for *mabouya* Lacépède).
- 1831 *Scincus (Tiliqua) aenea* Gray, in Griffith's Cuvier's Animal Kingdom, App. p. 70 (types in Brit. Mus., "Brazils". Type locality stated by Gray in 1838, Ann. Nat. Hist. 2, p. 292, to be "West Indies", and in 1845, Cat. Lizards Brit. Mus. p. 94, to be "W.I." and "St. Vincent's").
- 1838 *Tiliqua maculata* Gray, Ann. Nat. Hist. 2, p. 289 (type in Brit. Mus. from Demerara).
- 1838 *Tiliqua albolabris* Gray, *t.c.*, p. 292 (type in Brit. Mus. No locality).
- 1839 *Eumeces spixii* Duméril and Bibron, Erp. Gen. 5, p. 642 (substitute name for *agilis*, *bistratus*, and *nigropunctatus*).
- 1839 *Eumeces mabouia* Duméril and Bibron, *t.c.*, p. 646 (types in Paris. Martinique and Guadeloupe. Not intended as substitute for *mabouya* Lacépède).
- 1839 *Scincus laevigatus* Duméril and Bibron, *t.c.*, p. 646. (MSS name cited in synonymy of *mabouia* Duméril and Bibron).
- 1845 *Copeglossum cinctum* Tschudi, Fauna Peru. Herp., p. 45, pl. 3, f. 2 (type?; from forested regions of Peru [?= Oriente]).
- 1857 *Euprepis surinamensis* Hallowell, Proc. Acad. Nat. Sci. Philadelphia 8, 1856, p. 154 (type cannot be found. Surinam); Hallowell 1860, Journ. Acad. Nat. Sci. Philadelphia (2), 11, p. 80, pl. 4, f. 2.
- 1862 *Mabuia unimarginata* Cope, Proc. Acad. Nat. Sci. Philadelphia 14, p. 187 (type cannot be found. Panamá).
- 1862 *Mabuia lanceolata* Cope, *t.c.* (types U.S.N.M. 6041 (two specimens), from Barbados).
- 1875 *Mabuia alliacea* Cope, Journ. Acad. Nat. Sci. Philadelphia (2) 8, p. 115, pl. 6, f. 1 (low country, Costa Rica, Types U.S.N.M. 30619-20).
- 1879 *Mabuya metallica* Bocourt, Miss. Sci. Mex. Rept., p. 400, pl. 22B, f. 1 (type in Paris. Martinique).
- 1887 *Mabuia luciae* Garman, Bull. Essex Inst. 19, p. 51 (type in M.C.Z., from Sta Lucia).
- 1887 *Mabuia dominicana* Garman, *t.c.*, p. 52 (types in M.C.Z., from Dominica).

*Type*: Not known to be in existence.

*Type locality*: The Antilles and Sardinia. Restricted by Latreille (Hist. Nat. Rept. 2, p. 67, 1802) to the Antilles. Further restricted by me to the Lesser Antilles, since the part of Lacépède's *Lacertus mabouya* which refers to an American species is not applicable to Virgin Island or Greater Antillean forms.

*Range*: From St. Martin (intermediates with *sloanii*) in the Lesser Antilles, Colima and Vera Cruz in Mexico, south to Pallatanga in Ecuador in the Pacific side, to Bolivia, Matto Grosso, and São Paulo on the Atlantic side. Sea level to 6000 feet.

*Diagnosis*: No auricular denticles; appressed legs overlapping or barely separated; no middorsal stripe; normally four supraoculars, the anterior

small and not in contact with the frontal; no definite dorsolateral dark stripes; two frontoparietals; normally a single pair of nuchals; scales 28-34, sometimes with traces of three keels.

*Description:* For the range of variation see "Variation of *Mabuya mabouya*" (*antea*).

*Remarks:* The populations here considered under the single heading of *Mabuya mabouya mabouya* are numerous and quite diverse, but I am of the opinion that none is worthy of subspecific rank. Most previous authors have come to nearly the same opinion with regard to mainland groups, but have maintained a number of insular species.

The Central American forms for which the name *alliacea* is available might be considered a recognizable race, but there are no scale characters, only 70% of the population show the color characters, and the same coloration occurs in two other regions.

The Guiana population has an extraordinarily low percentage of parietal contact and a high percentage of supranasal contact. In the first character it is closely approached by the animals of Matto Grosso, and in the second it is equalled or closely approached by several other populations. Several names are available, the oldest being *maculata* 1838.

The name *lanccolata* is available for specimens from Barbados, but these do not seem to me to differ in any significant way from average specimens, and especially they do not differ from the surrounding populations of the Antilles from St. Vincent south and from the population of eastern Venezuela. For the latter the older name *acnea* is available, but I can see no reason for its racial recognition.

The islands from St. Martin to Sta. Lucia support a number of odd variants. Relatively few specimens have been seen or recorded. Sta. Lucia specimens differ from their neighbors and agree with more northern specimens in having more than one pair of nuchals. They also differ from their neighbors and agree with Bolivian specimens in having a fairly high percentage (60) of prefrontal contact. The name *luciae* is available but I believe it would be wiser not to use it.

The presence of three supraoculars on islands from St. Martin to Martinique might justify the recognition of a race. The name *agilis* would then apply to the rest. I do not make this distinction because of the small number of specimens available, because the variation occurs elsewhere, and because it occurs principally on St. Martin, Montserrat, Guadeloupe, and Martinique, and scarcely at all on Redonda, Marie Galante, or Dominica, so that the occurrence is somewhat haphazard in range.

The Dominican specimens show no important differences in themselves, and I see no reason to use the name *dominicana*.

St. Martin specimens, with dorsolateral dark stripes, 29% with more than one pair of nuchals, and a majority with three supraoculars, are anatomically and geographically intermediate between the specimens to the south and those to the north. The more northern specimens I regard as a recognizable race, *sloanii*. The more southern I shall here consider as a single race, *mabouya*. I see no reason to name the St. Martin intermediates.

**Mabuya mabouya sloanii** (Daudin).

1803 *Scincus sloanii* Daudin, Hist. Nat. Rept. 4, p. 287, pl. 55, f. 2.

1837 *Euprepes semitaeniatus* Wiegmann, Arch. Nat. p. 135 (type in Berlin, Berlin 5290, not seen, no locality).

1838 *Euprepes spilonotus* Wiegmann, l.c. (type Berlin 3758, not seen, no locality).

1838 *Tiliqua richardi* Gray, Ann. Nat. Hist. 2, p. 292 (substitute name for *sloanii* Daudin).

1862 *Mabuia fulgida* Cope, Proc. Acad. Nat. Sci. Philadelphia 14, p. 185 (Jamaica.

Types "probably exist in most of the larger museums". A.N.S. 9404-9, A.N.S. 13597-9, U.S.N.M. 5759 (six specimens), and a specimen in Paris, figured by Bocourt (Miss. Sci. Mex. 1879, p. 403, pl. 22B, f. 4) and received from this Academy, may be considered types).

1862 *Mabuia cuprescens* Cope, l.c., p. 186 (St. Thomas, type lost).

1887 *Mabuia nitida* Garman, Bull. Essex Inst. 19, p. 51 (Porto Rico and San Domingo [sic], types in M.C.Z., not seen).

*Type*: In Paris Museum, not seen, collected by Richard.

*Type locality*: St. Thomas, Virgin Islands (*vide* Duméril and Bibron, Erp. Gen. 1839, 5, p. 639).

*Range*: Southern Bahamas, Hispaniola, Jamaica, Mona, Porto Rico, and the Virgin Islands.

*Diagnosis*: A race of *Mabuya mabouya* with dark dorsolateral stripes; nearly always two or three pairs of nuchals.

*Description*: For range of variation see under *Mabuya mabouya* (antea).

*Remarks*: The specimens here considered under the heading of *Mabuya mabouya sloanii* have often been considered as members of three different species. The amount and distribution of the differences between the various island populations of the northern Antilles inclines me to regard them not even as subspecies, but as varieties.

Specimens from Jamaica, the Bahamas, Porto Rico, and Hicacos have narrow dorsolateral stripes. For this coloration the names *spilonota* (no locality), *fulgida* (Jamaica), and *nitida* (Porto Rican specimens) are available. Specimens from Hispaniola, Mona, Culebra, and the Virgins have broad dorsolateral stripes. For this coloration the names *sloanii* (St. Thomas), *semitaeniata* (no locality), and *nitida* (Hispaniolan specimens) are available. Some confusion has been caused by the notion that *sloanii* was based on a specimen with narrow dorsolateral stripes. These two color phases are not correlated with any scale differences, and their distribution is such that I agree with Schmidt (1928) in not recognizing them taxonomically.

It has been suggested that Jamaican specimens might be separated from those from Hispaniola to the Virgins as follows:

Jamaica: supranasals separated; nuchals three.

Hispaniola to the Virgins: supranasals in contact; nuchals two.

Actually, this diagnosis fits only 45% of the Jamaican specimens, and only 53% of those from the other islands. The few Bahaman specimens seen have separate supranasals, and the nuchals are 1-2 in one specimen and 2-2 in another. Although specimens from Jamaica and the Bahamas have separate supranasals, and those from Hispaniola to the Virgins have 69% supranasal contact, I do not feel that this scale difference is quite sufficient for taxonomic recognition.

In case others may wish to maintain races in this area the following arrangement and names can be applied:

1. Narrow dorsal stripes; supranasals separated; Jamaica and Bahamas. The name *fulgida* 1862, described from Jamaica, is to be preferred to the name *spilonota* 1837, of unknown provenance. The type of *spilonota* has the above characters and three nuchals, an arrangement in which 45% of the Jamaican specimens agree, but the indications are that 3% of the Porto Rican specimens also have these characters, so that it is by no means certain that the type came from Jamaica.
2. Broad dorsal stripes; supranasals in contact in 69%; Hispaniola, Mona, Culebra, and the Virgins. For this form the oldest name is *sloanii*.
3. Specimens from Porto Rico and Hicacos agree with Jamaican specimens in color, and with *sloanii* in supranasals. They are thus intermediates. Should anyone wish to name them, *nitida* is available if the name be restricted to Porto Rican specimens.

**Mabuya dorsovittata** Cope.

1862 *Mabuia dorsovittata* Cope, Proc. Acad. Nat. Sci. Philadelphia 14, p. 350.

1884 *Mabuya joberti* Thomiot, Bull. Soc. Philom. (7), 8, p. 148 (type not seen, probably in Paris. Itatiaia, Brazil).

1885 *Mabuia tetraetania* Boettger, Zeitsch. Naturw. 58, 4, p. 227 (type not seen, in Frankfurt. Paraguay).

*Type*: U.S.N.M. 5405, collected by the Paraguay expedition under Capt. Page.

*Type locality*: Paraguay.

*Range*: Brazil (from State of Rio de Janeiro south), Uruguay, Paraguay, and Argentina.

*Diagnosis*: A long-legged, long-tailed Mabuya; nearly always with a middorsal dark stripe and three supraoculars; light stripes narrow and vivid.

*Description*: (drawn up from 12 specimens examined) U.S.N.M. 5405 Paraguay, type; A.M.N.H. 23046-8 Ito Itatiaia, Serro do Itatiaia, Brazil; A.M.N.H. 5750 São Paulo, Brazil; U.S.N.M. 12352 Uruguay; A.M.N.H.

17025 Buenos Aires, Argentina; M.C.Z. 15893-5 Las Heras, Mendoza, Argentina. Also from 5 specimens mentioned in literature: 3 types of *joberti* from Itatiaia, Brazil; a specimen from Montevideo, Uruguay, figured by Bocourt in 1879 (Miss. Sci. Mex., p. 407, pl. 22c, f. 2); the type of *tetrataenia* from Paraguay.

The supranasals are in contact in the specimens seen except for 3 from Itatiaia. They are in contact, as far as the descriptions go, in all except the types of *joberti* from Itatiaia. (As far as I can make out, the locality thus variously spelled is Mt. Itatiaia, altitude 9199 feet, on the boundary line where the States of Rio de Janeiro, Minas Geraes, and São Paulo meet).

The prefrontals are separate in all except A.M.N.H. 5750 from São Paulo, in which some abnormality or accident seems to have taken place.

The frontoparietals are two in all specimens. The parietals are in contact in all except two: A.M.N.H. 23046 from Itatiaia, and A.M.N.H. 17025 from Buenos Aires. The nuchals are a single pair in all, except for: A.M.N.H. 23048 from Itatiaia, which has two nuchals on the left side and one on the right; and the types of *joberti* from Itatiaia, which are said to have one or two nuchals.

The supraoculars are three in all, except for A.M.N.H. 23046 which has three on the left side and four on the right, the anterior one on the right side being in contact with the frontal.

The eye is over the 5th labial in 9 of the specimens examined. It is over the 6th labial in the type, and in U.S.N.M. 73514 from Argentina. It is over the 5th on the left side and the 4th on the right side in M.C.Z. 15894 from Mendoza Province. In Bocourt's specimen from Montevideo, and in the type of *tetrataenia* from Paraguay it was over the 5th. The description of *joberti* does not mention this character.

The scale rows number 28 in the type of *tetrataenia* and in A.M.N.H. 17025 from Buenos Aires. They are 29 in U.S.N.M. 73514 from Argentina; 30 in the type, in U.S.N.M. 12325 from Uruguay, and in M.C.Z. 15893 from Mendoza; 32 in M.C.Z. 15894-5 from Mendoza. *Joberti* was described as having 28-30, and *tetrataenia* as 28.

The type has 59 scales between chin and vent. The Mendoza series in the M.C.Z. has 56, 63, 68. U.S.N.M. 73514 from Argentina has 65.

The coloration is described from M.C.Z. 15894 from Mendoza Province. Dorsal background brown; a narrow middorsal dark stripe to level of sacrum; a dark stripe from upper eyelid, covering one scale row and the halves of the adjacent rows, fusing on the tail into a middorsal caudal stripe; below this a narrow white stripe continuing onto tail; below this a dark stripe on the sides, covering one scale row and the halves of the adjacent rows, continuing onto tail; below this a narrow white stripe; below this a dark stripe, one scale wide from lower jaw to base of tail. A.M.N.H. 17025 from Buenos Aires has no color markings above the dark stripe on the sides, and thus resembles *M. mabouya* in color, save for the narrowness and vividness of the remaining stripes. A.M.N.H. 5750 from São Paulo likewise lacks the dorsal dark stripes, but the upper white stripe is vivid and a single scale wide. M.C.Z. 15895 has the general color rather dark and the middorsal stripe cannot be made out.

Various measurements follow:

Specimen	head and body	tail	locality
U.S.N.M. 12325 .....	60	75	Uruguay
M.C.Z. 15894 .....	75	108	Mendoza
A.M.N.H. 17025 .....	70	145	Buenos Aires
A.M.N.H. 5750 .....	61	118	São Paulo

*Remarks:* *M. dorsovittata* occurs with *M. mabouya* in the Brazilian States of Rio de Janeiro and São Paulo, and with *frenata* in Paraguay and in Argentina. Length of tail, color, and supraocular count are variable in both species. No specimens of *mabouya* have a tail as long as some *dorsovittata*, but the ratios of head and body length to tail length overlap. With sufficient attention to detail they can always be told apart by color. Specimens of *dorsovittata* with four supraoculars can be separated from *mabouya* with four because the former seem to have the anterior one triangular and in contact with the frontal, while *mabouya* has this scale splint-like and well separated from the frontal. When the supraoculars are three, this character cannot be used, as the two are exactly alike in it. Three supraoculars occur very rarely in southern *M. mabouya*. Despite the variability, I consider the two as distinct species. In fact, I feel that the nearest relative of *dorsovittata* is not any form of *mabouya*, but the species which I am describing from Matto Grosso and Bolivia. This has a long tail, a middorsal dark stripe, and while it has four supraoculars, the anterior is usually in full contact with the frontal.

It may be remembered that specimens from Itatiaya have the supranasals separate, while the rest have these scales in contact. This character is very variable in American *Mabuya*, and entirely too few specimens have been examined to make any decisions at this time, but it is possible that eventually a northern race, *M. dorsovittata joberti*, may be recognizable on the basis of this character.

Besides the localities already mentioned, Boulenger (1887, Cat. Lizards Brit. Mus. Nat. Hist. (2), 3, u. 192) records 4 specimens from San Lorenzo, Rio Grande do Sul, Brazil.

Boulenger (*l.c.*) considers that *Euprepis (Mabuia) virgatus* Peters 1874 (Mon. Berlin Ak., p. 621) from " ? Australian Islands " is a synonym of *dorsovittata*. Boulenger says that he examined the type. I record his statement without comment.

***Mabuya guaporicola*, sp. nov.**

*Type:* Carnegie Mus. 962, collected by Haseman, June 29, 1909.

*Type locality:* Headwaters of Rio Guapore in Western Matto Grosso. More specifically near Bastos Farm on Rio Alegre (where Haseman was on June 28, and whence he went downstream to the Guapore) which is above and not far from Villa Bella de Matto Grosso.

*Range:* Known from type locality and from Dept. Sta. Cruz, Bolivia.



*Diagnosis:* A short-legged, long-tailed *Mabuya*, pale with numerous dark stripes anteriorly.

*Description:* Drawn from the type and from Univ. Mich. 68099 from Sta. Cruz. Supranasals in contact; prefrontals separate; two frontoparietals; one pair of nuchals; four supraoculars, anterior broadly in contact with frontal in type, anterior barely in contact on right in Mich. 68099 and just missing on left; eye over fourth labial on left side and fifth on right in type, over fifth on left and fourth on right in Mich. 68099; scales 30 in type, 32 in Mich. 68099, smooth in both; 57 scales from chin to vent in type, 68 in Mich. 68099; yellowish brown, lighter below; nine dark stripes at level of axilla, five on tail; in type a middorsal dark line from level of axilla to level reached by tips of appressed fingers; a narrow dark line on tips of two adjacent scale rows from eyelid to base of tail where they fuse and form a middorsal line on tail; a lateral brown stripe, outlined with black, from snout through eye and thence on one scale row and the adjacent halves of two others onto tail; a light stripe from lip onto tail on the halves of two adjacent scale rows, bordered below by a narrow dark line from axilla to groin and onto tail; below this light; in the region of the axilla a lowermost dark line. In Mich. 58099 there is only a faint trace of the middorsal dark line, and the lowermost dark line extends from axilla to groin. Length of type 190 mm., tail 120, arm 12, leg 19, axilla to groin 40, gap between appressed toes 9 mm.; Mich. 68099 length 265 mm., tail 167, gap between appressed toes equals 8 scales.

*Remarks:* This is a very distinct form. In number of stripes and in shortness of legs it somewhat resembles *lineolata* from Hispaniola. In length of tail and somewhat in coloration it has possible affinities with *dorsovittata*. It occurs with *frenata frenata* and *mabouya mabouya* but is very different from either.

***Mabuya lineolata* Noble and Hassler.**

1933 *Mabuya lineolata* Noble and Hassler, Amer. Mus. Novitates 652, p. 16.

*Type:* A.M.N.H. 42145, collected Jan. 8, 1930, by W. G. Hassler.

*Type locality:* Monte Cristi, Dominican Republic, Hispaniola.

*Range:* Known only from type locality.

*Diagnosis:* A short-legged *Mabuya*; 26 scale rows; yellow, with ten black stripes and blue tail; two frontoparietals; anterior supraocular not in contact with frontal.

*Description:* The type and two paratypes have been seen (A.M.N.H. 42145, 51765-6). Supranasals in contact; prefrontals separated; two frontoparietals; parietals in contact; one pair of nuchals; four supraoculars, anterior triangular but not in contact with frontal; eye over fifth labial (on the right side of the type this scale is divided vertically in two); scales 26, smooth; appressed legs separated by the length of the hind leg or more; "dorsal surface of the head, body and tail (in alcohol) striped, a ground tone of gray divided on the dorsal surface by ten conspicuous stripes of dark brown, the two most ventral stripes on each side, about half the width of the two stripes immediately dorsal to them on either side; the latter extend-

ing from the region of the eyes the whole length of the body and well on to the tail; the dark stripes not co-equal in width to a scale but extending through the middle or the lateral portion of each scale. Ventral surface a uniform grayish tint except on the tail where the two most ventral stripes on the side of the body have converged to form two barely defined stripes on either side of the midline of the tail; "51765" differs from the two adults in the series by having a stripe on either side of the body in addition to the ten stripes of dark brown found in the adults. There is also some indication of five other longitudinal stripes of brown along the ventral surface of the belly"; "in life the dark stripes were nearly black while the light ones were lemon-yellow, changing into bluish at the tail-base. The tail was blue"; Snout to vent of type, 59 mm.

*Remarks:* This remarkably distinct form, which is found on Hispaniola along with a form of the *M. mabouya* series, shows so little similarity to any other American species that very little can be said about it. In shortness of legs, and in some features of the coloration, it resembles *M. guaporicola*. At least, it is much more like that species than it is like *M. mabouya sloanii* which occurs with it on Hispaniola. In spite of all the collecting that has recently been done on this island, only four specimens of *Mabouya* have been taken; three of *lineolata* and one of *sloanii*, and the specimen of *sloanii* was taken before 1887.

***Mabouya frenata frenata* (Cope).**

1862 *Emoca frenata* Cope, Proc. Acad. Nat. Sci. Philadelphia 14, p. 187.

1870 *Eumeces (Mabouya) Nattereri* Steindachner, Sitz. Ak. Wiss. Wien 62, 1, p. 339, pl. 3, f. 4 (types not seen, probably in Vienna. Brazil).

*Type:* U.S.N.M. 5855 (three specimens) and A.N.S. 9395.

*Type locality:* Paraguay River valley, Paraguay.

*Range:* Bolivia, Matto Grosso, Paraguay, Argentina, Chile.

*Diagnosis:* Similar to *mabouya mabouya* in color; differing in having a single frontoparietal and a broader frontal.

*Description:* Drawn up from 32 specimens, as follows:

BOLIVIA: Riberalta, Rio Beni, Mich. 63794; Ixiamus, A.M.N.H. 22454; Reyes, U.S.N.M. 84236; Tiraque, Mich. 68095; Buenavista, Field 16166, A.M.N.H. 37815, Mich. 63793, Mich. 60581; Dept. Sta. Cruz, Mich. 68096-7; Dept. Cochabamba, Mich. 68093 (2 spec.).

MATTO GROSSO: Chapada, M.C.Z. 28679, A.N.S. 12958-62, A.N.S. 12964, A.N.S. 12966, A.N.S. 12968; Descalvados, Field 9128, Field 10820-1.

PARAGUAY: Yhu, M.C.Z. 34227; Paraguay R. valley, U.S.N.M. 5855 (3 spec.), U.S.N.M. 5850, A.N.S. 9395.

ARGENTINA: Patagonia, A.M.N.H. 17026.

CHILE: Tolhuaca, Prov. Cautin, Field 9958.

Additional information has been derived from the description of the three types of *nattereri*; from a figure of Bocourt (Miss. Sci. Mex. 1879, p. 404, pl. 22c, f. 6, 6a); from reports of four specimens by Boulenger (1887, Cat. Liz. Brit. Mus. (2), 3, p. 194); and from a report by Boettger (1885, Zeit. Naturw. 58, 4, p. 228).

The supranasals are in contact in all; the prefrontals are separate in all except A.N.S. 9395 and Field 10820; the frontoparietals are fused in all (naturally, since this is the one important character separating *frenata* from *mabouya*); the parietals are in contact in all; the nuchals are normally a single pair (those of the two sides are fused in Field 9128, the left nuchal is absent in Mich. 63794, there are two on the left side in Mich. 68096, and two on the right in Mich. 68093b, while Boulenger says "sometimes two" in reference to four specimens from Brazil, Paraguay, and Argentina); the supraoculars are four in twelve Matto Grosso specimens except for A.N.S. 12959 which has three on the right side; four in specimens from Paraguay, Argentina, and Chile, except for one reported from Paraguay by Boettger and for U.S.N.M. 5955c from Paraguay, both of which have 3-3; three supraoculars predominate in Bolivia, 13 sides having three against 11 sides with four (northern specimens usually have four, Sta. Cruz specimens about equally three or four, Cochabamba specimens have three). The eye is over the sixth labial in the majority of specimens (about 86%), and about equally over the fifth or the seventh in the remainder. The scales occasionally show traces of three faint keels; are in 30-32 rows, almost 75% having 30. The ventral scales number from 52-61, the average of sixteen being 57.2. The coloration is similar to *mabouya mabouya*: a dark lateral band bordered above and below by narrow light lines; dorsum occasionally marked by spots or streaks, with some tendency to the formation of dorso-lateral dark lines; light lines sometimes very faint or absent; the young more brightly marked and with less dark on the dorsum (the types of *nattereri* had the "back with 3-5 rows of flecks, of which the inner sometimes unite into stripes").

*Remarks:* Besides the localities whence I have seen specimens Boulenger (1887) records it from Candelaria, Prov. Misiones, Argentina.

The form just described occurs with *mabouya mabouya* over large areas of Matto Grosso and of Bolivia. The coloration is identical and they are similar in size and in proportions. There seems to be no habitat difference, at least *frenata* occurs in the grassland at Reyes, and in the forest at Ixiamus, while *mabouya mabouya* has been taken in the forest at Tumupasa, near the other two localities. Both occur at Chapada and along the Paraguay and the Guapore rivers.

The frontal is narrower in all specimens with two frontoparietals except for Mich. 60580 from Buenavista, Bolivia, and this has a number of abnormalities of the head scales. There are a number of other scale characters whose distribution in the two types is interesting. In all *frenata* the supranasals are in contact. The situation is variable in *mabouya*, in Matto Grosso 50% have them in contact, in Bolivia 76%. Prefrontal contact is present in 10% of Matto Grosso *frenata*, and is not known in Bolivian *frenata*. In Matto Grosso 20% of the *mabouya* have prefrontal contact, in Bolivia 59%. All *frenata* have the parietals in contact; 20% of the Matto Grosso *mabouya* have parietal contact, and 70% of the Bolivian *mabouya*. In 4% of the Matto Grosso *frenata* there are three

supraoculars; in Bolivia 54% have three supraoculars. No Matto Grosso *mabouya* and only 6% of the Bolivian *mabouya* have three supraoculars. The eye is over the fifth labial in no Matto Grosso *frenata*, in 12.5% Bolivian *frenata*, in 15% Matto Grosso *mabouya*, and in 88% Bolivian *mabouya*. Thirty scale rows are present in about 82% Matto Grosso *frenata* and about 22% Matto Grosso *mabouya*.

In most of these characters *frenata* and *mabouya* vary in the same direction as one goes from Matto Grosso into Bolivia. This is true for subocular and for supraocular. For supranasal and for parietal contact Bolivian *mabouya* is closer to *frenata* than is Matto Grosso *mabouya*. In prefrontal contact this trend is completely reversed, as the scales are less frequently in contact in Bolivian *frenata*, and much more frequently in contact in Bolivian *mabouya*.

The foregoing facts incline me to think that we have to deal with two distinct species, although they are so much alike that the frontoparietals offer the one sure means of distinguishing them.

The tendency to three supraoculars in Bolivia, together with features of coloration and proportions, leads me to suggest that an interior Bolivian race of *frenata* be recognized. The details concerning it will immediately follow.

***Mabouya frenata cochabambae*, sp. nov.**

*Type*: Mus. Zool. U. Mich. 68094a.

*Type locality*: Pocona, Dept. Cochabamba, Bolivia.

*Range*: Known only from type locality and from Dept. Sta. Cruz, Bolivia.

*Diagnosis*: Smilar to *M. frenata frenata*, but with more marked dorsal dark striping (usually a median dark stripe); three supraoculars; shorter legs.

*Description*: Drawn up from Mich. 68094 (four specimens) from Pocona, and from Mich. 68098 from Dept. Sta. Cruz.

Supranasals in contact except in 68094a; prefrontals separate in all; frontoparietals single; parietals in contact; nuchals 1-1; supraoculars 3; eye over sixth labial except in 68094b, where it is over the fifth on the right side, and in 68094c where it is over the fifth on both sides; scales 31 in 68094a and 68094d, 32 in 68094b, 30 in 68094c and 68098; ventrals 64 in 68094a, 66 in 68094b and 68098, 60 in 68094c and 68094d; appressed toes well separated in 68094a and 68094b, just missing in 68098, touching in 68094c and 68094d; coloration of a dark lateral stripe covering two scale rows and two half rows; a narrow light stripe above and below the dark lateral stripe; a dark dorsolateral stripe above upper light line from hind end of eyelid to base of tail; dorsal region with three dark lines (tips of all scales dark) in 68098; 68094d similar but median dark stripe more emphasized; 68094a and 68094c with a single median dark stripe; 68094b with a vague median dark stripe.

*Remarks:* The variability of this form can be seen from the description. Its relationships are evidently with Bolivian *frenata*, which has a high percentage of specimens with three supraoculars. The specimen 68094a is the most different from *frenata*, while the specimen 68098 is the most similar. There is a superficial resemblance to *dorsovittata*, in which, however, the frontoparietals are double, and in which the two dorsolateral dark lines fuse to a middorsal caudal stripe.

**Mabuya deserticola**, sp. nov.

1930 *Mabuya nigropalmata* Burt and Burt, Proc. U. S. Nat. Mus. 78, 6, p. 42 (not of Andersson 1918).

*Type:* U.S.N.M. 13826, collected by Dr. W. H. Jones, Sept. 28, 1883.

*Type locality:* Mollendo, Peru.

*Range:* Known only from type locality.

*Diagnosis:* Similar in scalation to *Mabuya frenata*, but quite different in color; dark, with three light stripes.

*Description:* Supranasals separate; prefrontals separate; one frontoparietal; parietals in contact; one pair of nuchals; four supraoculars, anterior small; eye over fifth labial; 29 rows of smooth scales; 62 scales from chin to vent; dark olive above, light below; a median narrow light stripe, and a similar dorsolateral stripe; length of head and body 42 mm., tail injured.

*Remarks:* This is the only specimen of *Mabuya* seen or reported from the desert area of the west coast. It cannot be called *frenata* because of coloration, nor can it be called *nigropalmata* because of scalation. In scalation it is similar to *M. frenata* except that all *frenata* have the supranasals in contact, and the eye is almost always over the sixth labial. A single specimen of typical *frenata* has been seen from west of the Andes in the birch forest region (Prov. Cautin, Chile). *M. mabouya* is known to occur in the rain forest on the west coast of Colombia and Ecuador. It is a pity to have to describe a species on a single small specimen, but the specimen cannot be placed with any known species, and is the only representative of the genus west of the Andes between latitudes 3 and 37 south. It is probably closest to *M. frenata*.

**Mabuya nigropalmata** Andersson.

1918 *Mabuya nigropalmata* Andersson, Ark. Zool. 11, 16, p. 8.

*Type:* Five specimens in Stockholm, not seen, collected by A. Roman (1, Brazil), and N. Holmgren (4, Bolivia).

*Type locality:* Rio Curucá, Brazil [western Amazonas, a tributary of the Javary near its junction with the Marañon, alt. app. 500']; San Fermin, N. W. Bolivia, forest district [near Peruvian border, alt. app. 5000'].

*Range:* Known only from the two type localities and from Mt. Turumiquire, N. E. Venezuela, at altitudes of 5400-7200'.

*Diagnosis:* A long-legged *Mabuya* with one frontoparietal; prefrontals broadly in contact; 2-5 (usually 3) pairs of nuchals; 28-32 (usually 30) scale rows; a light middorsal stripe.

*Description* (drawn up from 26 specimens, A.M.N.H. 29314-5, A.M.N.H. 29318, A.M.N.H. 37882; Field Museum 17796-7, 17798 a-c, 17799 a-e, from Mt. Turumiquire at 6000 feet; Carnegie Mus. 7978, 7986-94, 7982, and 7995, from Mt. Turumiquire at altitudes of 1650, 1700, 1750, and 2200 meters respectively): The supranasals are separated in all but two specimens (Carnegie 7978, 7989); the prefrontals meet in a broad suture in all; all have a single frontoparietal; the parietals are in contact in all; the nuchals are from two to five, a single specimen (Field 17799 c) has two on both sides, 13 have 3-3, and two (Carnegie 7987 and Field 17798 c) have 4-4; ten specimens have the two sides of the head different; of the 52 sides counted, 2 have two nuchals, 33 have three, 14 have four, and 3 have five; the supraoculars are four in all, the anterior being triangular, and making contact with the frontal in 8 of the 52 cases; the eye is over the 5th labial in 33 cases, and over the 6th in 19; the scale rows are 28 in five cases, 29 in two, 30 in twelve, 32 in two; two to four of the middorsal scales are distinctly enlarged, and the dorsal scales show faint traces of triple keeling in many of the specimens; the scales from chin to vent have been counted in 21 specimens, the range being 54-67, and the average 60; the appressed limbs overlap; the dorsal color is dark, with a middorsal white line from snout to base of tail, and dorsolateral white lines from upper eyelid onto tail, the latter enclosing thus two dark stripes from the upper eyelid which fuse on the tail to a middorsal caudal stripe; sides mottled dark and light, an ill-defined light line from under eye over arm to groin; below the sides gradually become lighter and merge into the light ventral surface; ventral surface much flecked with black in adult; ventrolateral light line more prominent in young; palms and soles black; largest specimen, head and body 76 mm.; an adult female, head and body 70 mm.; Field Mus. 17799 c, head and body 67 mm, tail 99 mm.

*Remarks:* A comparison of the characters of these specimens with Andersson's description of *nigropalmata* leaves me no option save to use that name for them. The scale characters mentioned by him are those given above, save that his five specimens were said to have 26-30 scale rows, and 2-3 pairs of nuchals (usually 3), and the first supraocular usually in contact with the frontal. The coloration given by him agrees, save that he speaks of "two longitudinal series of black spots on the back", "a black band on the side", and does not mention any ventral flecking. His largest specimen measured, head and body 60 mm., tail 88.

I feel that the Turumiquire specimens are certainly conspecific with the types of *nigropalmata*. Future material may show that the species can be divided into races on the basis of the Venezuelans having, on the average, more scale rows, more nuchals, and a smaller percentage of contact between the frontal and the anterior supraocular, but I do not believe in naming animals on the basis of what the future may show.

It is amazing that a lizard described from so far away should show up on a mountain near the coast in Venezuela, but it is equally amazing that five specimens of a new *Mabuya*, from two almost equally remote localities, should turn up in Stockholm together. It is certainly 1100 miles from Mt. Turumiquire to the Rio Curucá, but it is at least 600 miles from the Rio Curucá to San Fernin.

The species is an extremely distinct one. The high number of nuchals, the large size of the anterior supraocular, the enlarged middorsal scales, the invariable prefrontal contact, and the color, combine to indicate a form quite different from other American *Mabuyas*. The nearest approach is made by *M. deserticola* from the coastal desert of Peru, as it, *frenata*, and *nigropalmata* agree in having a single frontoparietal, and it and *nigropalmata* agree in having a middorsal light stripe. *Deserticola* has three narrow light stripes and four broader dark ones; *nigropalmata* has five narrow light stripes and six broader dark stripes or areas. In nuchals, anterior supraocular, prefrontals, and dorsal scales, they disagree.

On Mt. Turumiquire this species occurs with *M. mabouya mabouya*. My friend and colleague Dr. M. Graham Netting collected the latter at 1700 and 1730 meters elevation in that area. At 1700 meters, on Jan. 18, 1930, he collected three *M. nigropalmata* and one *M. mabouya*. The vertical range of the two, in that area, seems to be: *M. mabouya mabouya*, sealevel to 1730 meters; *M. nigropalmata*, 1650 to 2200 meters. Both the high and the low altitudes for *nigropalmata* and the high altitude for *M. mabouya* are due to Dr. Netting. *M. mabouya* is known to reach 6000 feet (=1830 meters) elsewhere in Venezuela.

*Note:* I am unable to recognize the following forms among the American *Mabuya* I have seen. They may refer to American species which are exceedingly rare, or they may not be American.

1. *Eumeces (Riopa) fischerii* Bocourt 1878, Ann. Sci. Nat. (6), 7, 16, p. 1: *Riopa fischerii* Bocourt 1879, Miss. Sci. Mex., Rept. p. 416, pl. 22F, f. 1. This specimen from Puerto Cabello, Venezuela received from the Hamburg Museum, had a scaly lower eyelid; nostril in the middle of nasal; supranasals in contact; prefrontals separate; two frontoparietals; parietals in contact; nuchals 1-1; supraoculars four; eye over fifth labial; 28 smooth scales; chin to anus 47 mm.; tail 57; arm 9; leg 13; head 9; legs short; "yellowish brown . . . six longitudinal lines . . . on the back and on a part of the tail . . . sides of the body . . . well separated from the dorsum by a black line . . . are strongly dotted with black". Boulenger (1887, t.e., p. 309) places this in the synonymy of *Lygosoma (Riopa) albopunctatum* of British India.

2. *Euprepis ocellatus* Bocourt 1879, *l.c.*, p. 414, pl. 22C, f. 8. This specimen from North America had scaly lower eyelids; separate supranasals; prefrontals in contact; two frontoparietals; parietals separate; nuchals 1-1; four supraoculars. Boulenger (*l.c.*) refers this to the synonymy of *M. multifasciata* of Malaya.
3. *Trachylepis* (*Xystrolepis*) *punctata* Tschudi 1845, *Unters. Fauna Peruana*, *Herp.* p. 44, pl. 3, f. 1. This specimen from Peru, with triply keeled scales, does not seem to me to be a *Mabuya*, but I am unable to say what it is. Boulenger (*l.c.*) considers it to be an otherwise unknown species of *Mabuya*.



ABSTRACTS OF MINUTES OF THE PROCEEDINGS OF THE  
ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA

FEBRUARY 19, 1935

Annual Meeting of the Academy.

Thirty members present.

The President, Mr. Effingham B. Morris, in the Chair.

Annual reports covering the year 1934 were presented by the Managing Director and by the Treasurer.

The following were reported enrolled as members since the February, 1934 meeting of the Academy:

*Sustaining Member:* Mrs. Margaret Emerson.

*Life Member:* Dr. Leo S. Rowe.

*Contributing Member:* Mrs. John C. Atwood, Jr.

*Annual Members:* Mrs. S. G. Armistead, F. Wallis Armstrong, Jr., Leonard C. Ashton, D. Moreau Barringer, Jr., Samuel Bell, 3rd, Griscom Bettle, Frederick Bolles, John E. Bowers, Henry Breuninger, Mrs. O. H. Bullitt, John Cadwalader, Jr., Mrs. J. Hamilton Cheston, Josef Cisar, Mrs. Clarence H. Clark, Mrs. Walter Clark, Woodward W. Cockran, Mrs. Walter I. Cooper, Mrs. William A. Dick, Mrs. Henry P. Erdman, Mrs. Edward W. Evans, John Kennedy Ewing, 3rd, Percy C. Feger, Mrs. Charles Fearon, Mrs. William W. Fitler, Sr., Mrs. Clarence H. Geist, Charles G. Graff, Julius Grodinsky, Mrs. Frazer Harris, Mrs. Edward Y. Hartshorne, C. Fenno Hoffman, John J. Howard, Grant Hultberg, Henry Hand Jones, Spencer L. Jones, W. P. Klapp, Jr., E. J. Kopp, Dolf L. Levy, Joseph Wharton Lippincott, Mrs. Adolf Loeb, Stuart F. Louchheim, John A. McKnight, Mrs. Harry Markoe, Miss Margaret Crozer Martin, Miss Annetta R. Masland, Miss Mary T. Mason, W. E. G. Miller, Miss Helen S. Milligan, Miss Mary C. Milligan, Frank H. Moore, Jr., Harry R. Neilson, Mrs. William L. Nevin, Mrs. George P. Orr, L. Rodman Page, William T. Patterson, Joseph E. Pennock, Miss Clara N. Perine, Mrs. William R. Philler, Karl de Schweinitz, Miss Anna M. Serrill, W. Spencer Service, Miss Stephanie E. Sheble, Geoffrey S. Smith, Stanley C. Snow, Floyd T. Starr, Francis R. Strawbridge, James G. Vail, L. W. T. Waller, Jr., Charles Willing, David Weber, Louis W. Wheelock, Mrs. Edward F. R. Wood, John Woodall.

*Junior Members:* Valdemar Anderson, Master John McC. Arnett, Everett H. Brown, 3rd, Miss Noel T. Cooper, Miss Ann Gray Dolan, H. Hoffman Dolan, Jr., Miss Peggy Thayer Dolan, Thayer Dolan, Thomas Dolan, 4th, David Montgomery Hart, Miss Elizabeth Ann Hirsch, Louis

Allen Hirsch, Jr., Charles Edward Ingersoll, 2nd, Miss Phoebe W. Ingersoll, Walter James Johnson, Jr., Miss Elizabeth Branson Ketcham, Miss Isabel Key Meade, John Sergeant Price, 3rd, Philip M. Smith, Miss Anne F. Wood, Edward F. R. Wood, Jr.

Deaths of the following members were announced: A. C. Albrecht, Mrs. E. R. Artman, Miss Julia H. Binney, Dr. Theodore W. Bouchelle, Louis Burk, John Cadwalader, Daniel H. Carstairs, E. Waterman Dwight, George L. Farnum, Thomas Fisher, Mrs. Stanley G. Flagg, John Marshall Gest, Charles L. Glanz, Prentiss N. Gray, Mrs. Elizabeth B. Gribbel, Edward Y. Hartshorne, Miss Mary Euphemia Hebard, James A. Hutchison, Alba B. Johnson, Edward J. Lavino, Mrs. Horatio Gates Lloyd, Miss Jessie W. Masters, Howard S. Roberts, George W. Roydhouse, William M. Savin, John C. Scott, James Spear, Jr., Walter Wood, Miss Quita Woodward.

The death of the following Correspondent was also reported: Professor Chiyomatzu Isikawa.

The second award from the George W. Carpenter Fund was made to Dr. Henry A. Pilsbry, for his work on "The Land Mollusks of North America". The award, made on the recommendation of the Carpenter Prize Committee appointed by the Board of Trustees, carries with it funds for the publication, by the Academy, of the monograph for which the award was made.

Following their nomination by the Nominating Committee as prescribed by the By-Laws, the following individuals were elected members of the Board of Trustees for a period extending to the Annual Meeting of 1938: Cary W. Bok, George L. Harrison, Arthur E. Newbold, Jr., E. R. Fenimore Johnson and M. L. Parrish.

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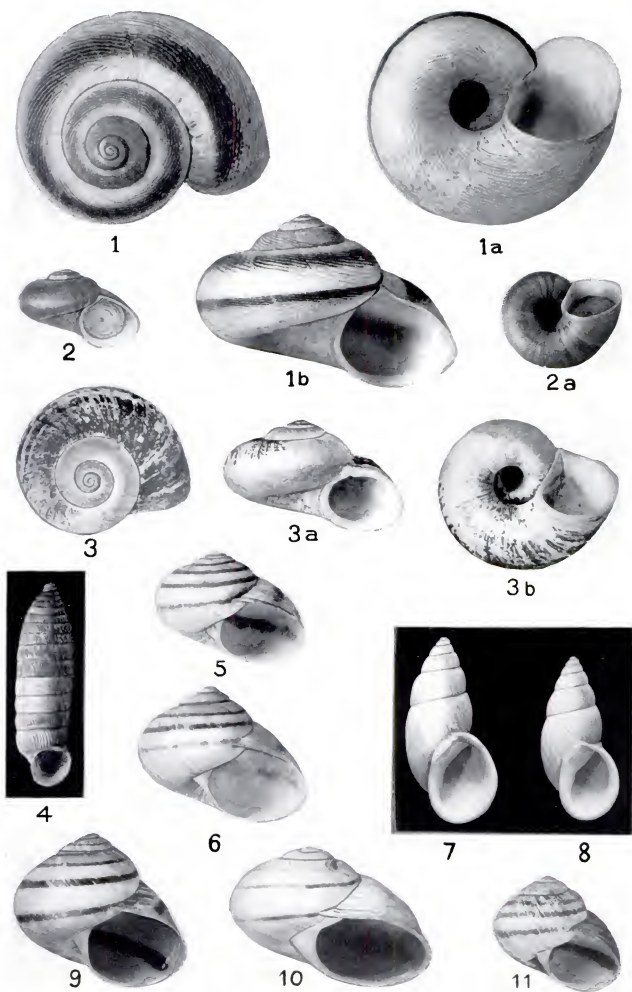
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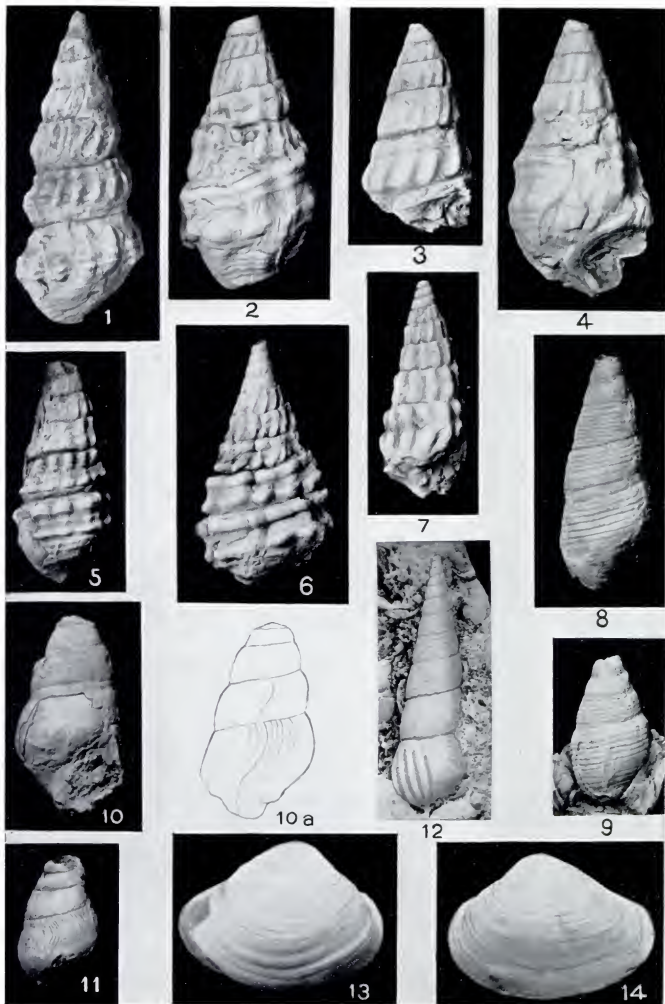
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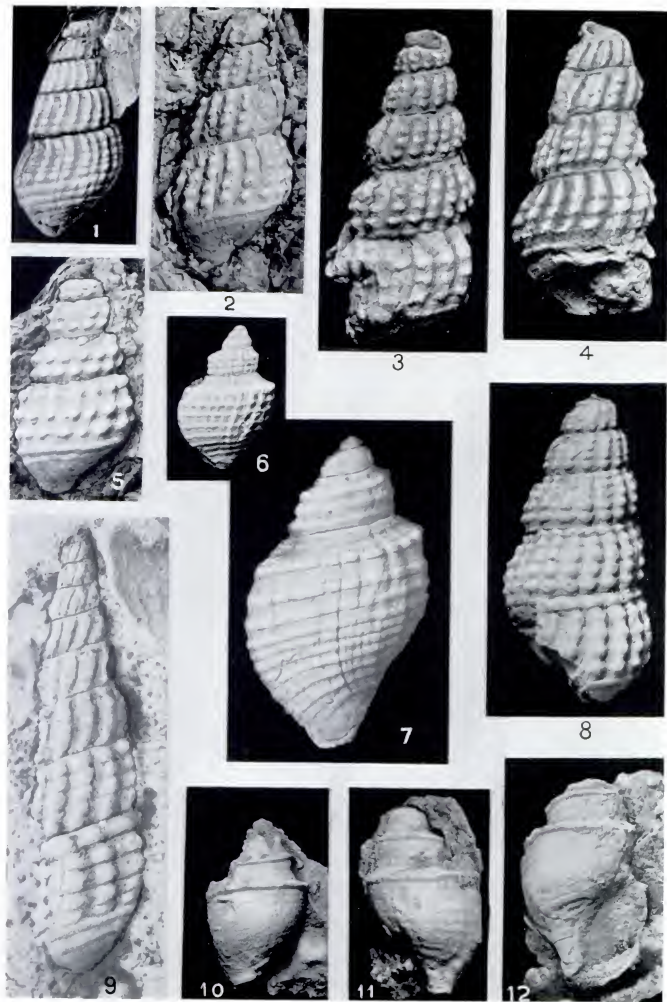
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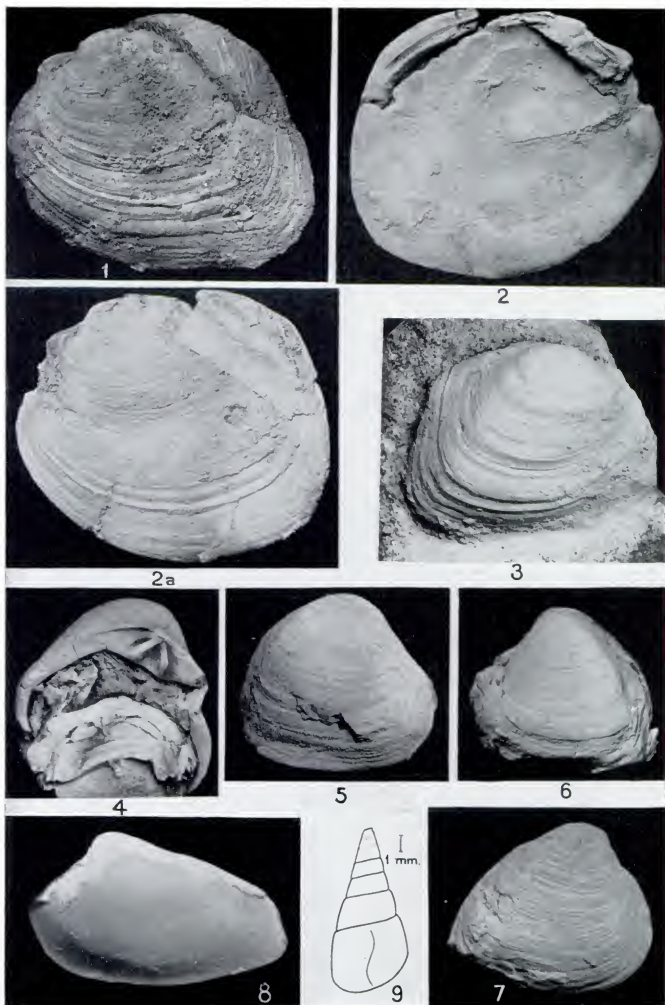
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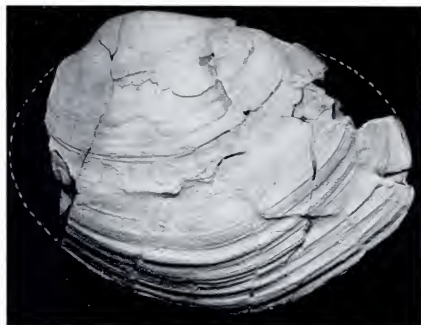
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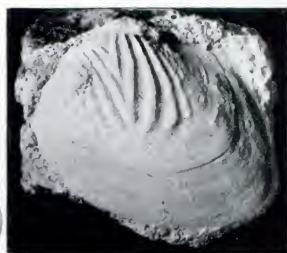
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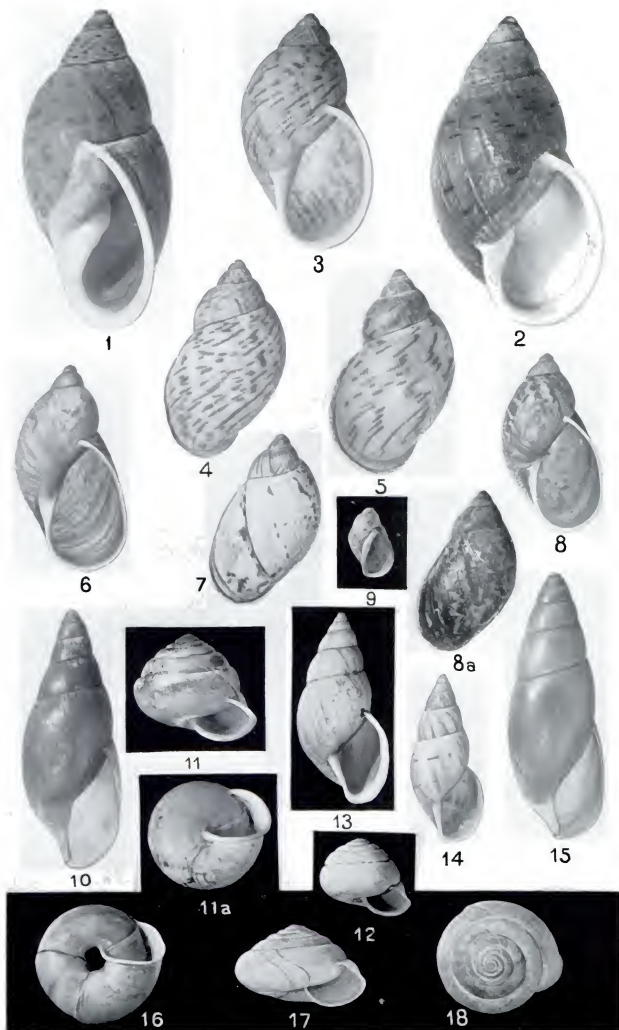
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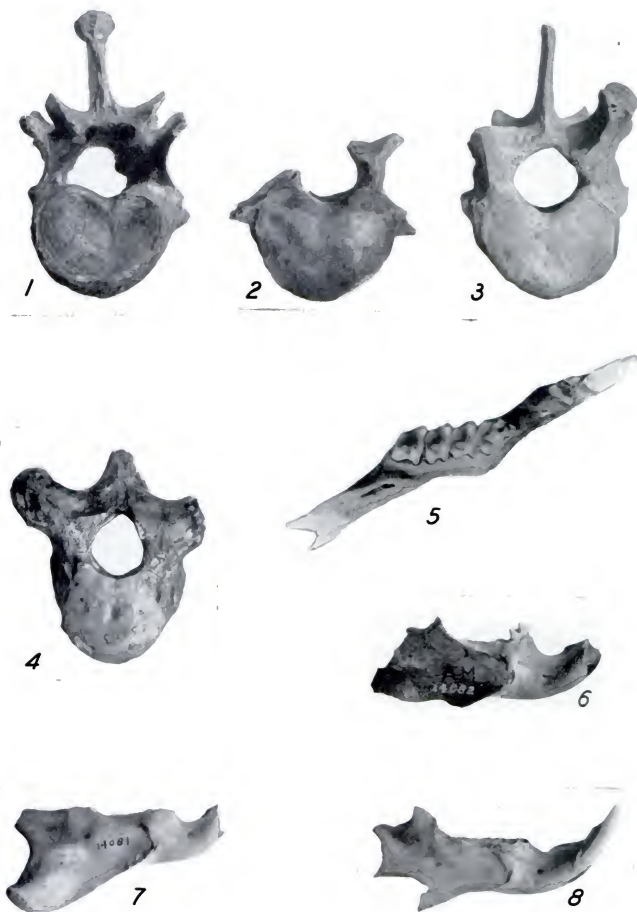


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